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The Hand Drill in Prospecting Placer Deposits

Methods of Drilling, Especially with Rotation of Casing, and the Advantages and Disadvantages as Compared with Steam-drill Prospecting

BY JOHN POWER HUTCHINS*

There are many areas in regions so inaccessible that reaching them with a steam prospecting drill involves an almost prohibitive expenditure of time and money. There are also numerous placers, the surface conditions of which are such that moving the heavy power drill over them is a costly and slow process. Under these conditions, which prevail in the swamps of the more inaccessible arctic and tropic zones, it is often preferable to use a hand drill, the cost being lower and the speed greater than with a power drill. The same is true of other places, where fuel, water, skilled labor, repairs and renewals are matters of difficulty and expense, or where unhealthful climate, heavy rains, and unfavorable weather prevail.

The advantages of hand drills as compared with steam drills are obviously those of mobility, although the possibility of operating with cheap, acclimated, unskilled labor, with very little wear, tear, and breakage, where no machine shops are available, is also an important consideration. There is also another extremely important advantage and that is the accuracy of the core obtained. One type of hand drill is so designed and manipulated that it produces cores probably more accurate than those of any drilling method which uses driving as a means of sinking drive pipe. Inasmuch as the object of the whole drilling operation is to get a correct idea of the value and the character of the mineral deposit, this advantage in the matter of cores is one of prime importance.

There are two kinds of hand drills, one which does what the steam prospecting drill accomplishes in the same way, except that hand power is used instead of steam, and another which achieves the same result as the steam drill, but in an essentially different way.

LOWERING THE DRILL ROD. WASHING PUMP IN BACKGROUND

Hand Drills Employing Drive Pipe

These drills resemble the steam drill in that they employ a pipe driven into the deposit. The means used for driving are somewhat varied, depending upon different arrangements for delivering the blow. The means employed vary in mechanical detail, but the principle of striking a heavy blow to sink the pipe is the same in

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all. The simplest method is to strike the pipe with a heavy hammer or maul. Inasmuch as only a comparatively light blow can be struck in this way, only drive pipe of small diameter can be used, and only shallow depths can be attained. A heavier blow can be obtained by hanging a hammer on a tripod by means of a rope and a single sheave, several men raising and dropping the weight alternately. Still greater power can be secured by using a weight, hoisted by a mechanical device worked by hand to a hight of more than 10 ft., and dropping it like the hammer of a pile driver. By this means 2-in. pipe can be sunk more than 100 ft.

The limit of depth is not always that to which pipe can be driven. Any driven pipe is harder to pull than to drive into the ground, and the capacity of the pulling arrangements therefor, frequently limit the depth that can be reached. Frequently when pipe is driven hard, it cannot be pulled without extreme difficulty, if it can be recovered at all. This is true in steam drilling as well as in hand drilling. With the limited power of hand drills, the diameter of the pipe must necessarily be small, and the deeper the hole the smaller the diameter that can be used. As a result the samples obtained are small.

Pipe sunk by driving must be heavier than that used by drills which rotate the pipe. That used by the first type of drills is called in this article drive pipe, that used in the second method of drilling is called casing.

The operation of drive-pipe hand drills generally consists, as with the steam drill, in the following three consecutive and separate operations: Driving pipe, drilling the core and pumping the drillings. These operations are in the two methods of prospecting generally done in the same way, using a rope to suspend the tools. A hollow drill rod may be used with a current of water forced to the bottom of the drill hole to wash up the drilled material and its mineral content to the surface of the ground.

Inasmuch as the hand drills which drive by percussion have difficulty in driving and pulling and thus make slow progress and get small samples, they are inferior to those which use the rotation method for sinking the pipe.

Drilling with Rotated Casing

There are two types of hand drills which employ rotated casings. One uses a platform on the top of the casing for the men to stand upon while drilling, their weight aiding in forcing the casing down as it is rotated by man or animal power. The other has no platform, the men who do the drilling standing on the ground. The pipe is rotated only when it is being driven or pulled and not while drilling is going on. Pipe wrenches are used in forcing the pipe around in its hole.

The hand drill which employs rotation as a means of sinking its casing was evolved more than 25 years ago in testing the tin placers of the Dutch East Indies. This work was done by the Dutch government under the supervision of its engineers, and the drill is the result of keen observation and ingenious improvement extending over a number of years. Its uses as a means of investigating metalliferous alluvion antedates the introduction of the steam churn drill for this purpose by several years. A drill very similar in construction and operation was used contemporaneously in this country in drilling wells and in testing phosphate deposits.

At present no other drill is used in the Dutch East Indies and on its results the government determines the value of the stanniferous placer deposits, a value which is accepted by the leasers who work them. I used the drill in conjunction with shafts in examining placer ground in tropical South America and found it admirably suited to the hostile environments of the tropical regions.

The drilling outfit is similar to that used with other systems. It consists of a casing with a shoe, bits, pumps, augers, drill rods, etc. The method of operation in brief is as follows: Drilling is accomplished with one of several tools, adapted to the peculiarities of the material to be penetrated. The tool, screwed to a solid or hollow drill rod, is operated like a churn drill inside the casing by the men who stand on the platform. The casing is rotated by men on the ground, or by means of a horse walking around in a circle. The lower end of the casing has a toothed cutting shoe, which aided by the weight of the apparatus and that of the men upon the platform and the rotary motion imparted to the whole, cuts and sinks into the ground inclosing a core. The core is drilled and at the same time forced up into a tool, which drills and pumps simultaneously. The tool is oc-

STARTING HOLE IN OVERBURDEN

DRIVING PIPE IN INDURATED GRAVEL

casionally lifted out of the casing and emptied.

Drilling With the Auger Bit

Suppose, as is often the case, a barren overburden covers the gravel to be drilled. This material can often be bored without casing, thus permitting of greater speed than when casing is used, for in the absence of casing there is no need of coupling and uncoupling rods. The tool generally used in this work is a spoon drill, which, as its name indicates, can be used as an auger in loose material, and to a considerable degree as a drill in harder soil, in stiff clay and when roots are encountered. The drill-rod handle is attached to the rod at a convenient hight. Two, three or four men manipulate the auger drill, one or two steadying the rod and holding it upright while the others rotate it. The barrel of the tool tapers toward the bottom, and other features of its design also help to hold excavated material; when the overburden is sandy or clayey soil possessing even a slight amount of cohesion it can be worked rapidly with this tool.

When the barrel is full the tool rod and drill-rod handle are lifted bodily out of the hole without uncoupling and emptied, a sharp stick being used to scrape out the barrel. The tool is then put back in the hole and the operation repeated. When material is encountered firm enough to make boring slow work, the men use the spoon drill somewhat like a churn drill, raising it and driving it down into the material with considerable force, and rotating it. Very stiff clay and roots of trees can be penetrated in this way at a rapid rate, the bit being designed for rough use of this kind.

A hole 6 in. in diameter can often be sunk 10 to 15 ft. in much less than one hour. If water is encountered this tool cannot always be used, for excavated material, if very wet, is likely to slip out and back into the hole. There are other tools that can be used under such circumstances, designed to work below water level.

Introducing the Casing

When the overburden has been penetrated and gravel containing gold has been encountered, casing sections, the lower one having a cutting shoe, may be screwed together and lowered into the hole, which has been made of sufficient diameter for this purpose. Enough casing is used to have several feet projecting above the ground when the cutting shoe is resting on the bottom of the hole. The top-head is screwed on the top of the casing and the platform placed on the top-head. Two to four men now mount the platform and connect to the rod sections a drill, a pump, a small spoon drill, a drill-auger pump, a helical-auger pump, a jar pump or some other tool.

While this is being done, two to four men slip poles (like capstan bars which may be as much as 15 ft. long) through chain loops on the periphery of the platform and walk around in a circle on the ground heaving on the bars as at a capstan. They thus rotate the casing which usually sinks several inches into the ground yielding several inches of core. As soon as sufficient core is inclosed, which is indicated by comparing the total length of the rod and tool in the casing with that of the casing, the men on the platform begin churn drilling. The boring action of the cutting shoe usually sinks the casing considerably ahead of the tool operated by the men on the platform and loosens the core somewhat, thus preparing it for easier working. Generally a tool is used which is so designed that it drills and pumps or bores and pumps, as it is churned up and down.

In this process the casing is sunk, and the core is drilled and pumped simultaneously. On the other hand in the operation of the churn drills with drive pipe, the procedure is to drive the pipe, then drill the core, and later to pump the drilled material. These are separate and consecutive operations, and each of them requires changes of tools and manipulation, all of which consumes time.

When the pump barrel is filled, the tool is lifted out of the casing and emptied into a receptacle. While the pump barrel is being cleaned and washed, another tool, either of the same or of a different type is screwed on and lowered into the casing; rotating and drilling are resumed and thus the work goes on; more drill-rod and casing sections are added with greater depth until the hole is finished.

Some of the Difficulties

When hard boulders, too large to go into the casing, are encountered, it is necessary to use a plain drill bit and to drill below the casing until the boulder is crushed. As a matter of fact, egg-shaped boulders, longer on one axis than the inside diameter of the casing, are often forced into the casing by the action of the teeth of the cutting shoe. I have found boulders wedged in this way after pulling casing with a 12-in. core from a finished hole to examine the material from bedrock in an undrilled condition. I think that the rotation of the casing twists such boulders until they slip into it. The rotation of the casing is here described as being done by men. Animal power of any kind may be used instead with a saving of about 30 to 40 per cent. in labor expense.

The rotation of the casing is a feature essentially different from that of any other churn drill, and it offers a number of important advantages as has been pointed out. It is seldom necessary to resort to driving to sink the casing, and even indurated material can be penetrated at a surprisingly rapid rate. Buried timber, if not in a good state of preservation, can be penetrated without resort to other means. There is considerable weight on the platform varying from 300 to 600 lb., according to the number of men detailed to handle the drill tools. The platform itself weighs about 200 lb., and the total weight may be increased by means of weights and by causing the men, who walk around in a circle rotating the casing, to put some of their weight on the bars. This is usually sufficient to sink the

PULLING CASING WITH LEVER

RAM USED IN DRIVING PIPE

casing ahead of the tool and to maintain an ample core.

If for any reason the casing does not go down when subjected to combined pressure and rotation, it can be driven by means of a timber weighing over 200 lb. and handled by four men like a paving ram, or by means of a heavier timber, suspended from a tripod and worked by a rope over a single sheave and operated like a pile driver. While driving is going on, the casing is constantly rotated and thus kept loose, a maximum of sinking being thus accomplished with a minimum of driving. As driving casing by a series of blows tends to push material away from the cutting shoe and thus to give incorrect cores, this hand drill gives better results when a minimum of driving is required.

Tools Employed

The tools used with this drill merit special comment. In the 25 or more years during which this drill has been used peculiar and ingenious appliances have been evolved. A spoon drill, which drills or bores and holds the material which it excavates, is one of the most effective of the tools employed. It is useful particularly in sinking in barren overburdens which will stand without casing as already described. After the casing has been started in a hole, a combination tool which works as a drill and auger, or as a drill and sand pump may be used. As it is churned up and down it loosens material from the core and catches it in the pump barrel where it is held by a valve.

The use of this drill pump offers several advantages. Drilled material is picked up by the pump as soon as it is detached from the core, and does not accumulate as sludge, with the result that no work is wasted in drilling loose material, and the drill pump is constantly striking a comparatively clean surface. Then also the core is removed with a minimum amount of change from its original characteristics and contents. This is an important point, for when the material is long subjected to the churning action of the drill, there is a loss due to attrition of the metallic content and its suspension in the muddy water. There may also be a change in the characteristics of the material penetrated, if it contains rotten boulders which may appear as clay after being subjected to the puddling effect of the drill.

Pulling the Casing

In pulling and recovering the casing after a hole has been finished, the platform and top-head are removed and a pulling cap is screwed on the top of the casing. This device permits the use of two levers, one to twist the casing forward and backward, and the other to lift by placing it on a fulcrum, near the casing, some of the men bearing down on the power arm. With a long stick a force 20 or more times the weight of the men can be exerted. As a matter of fact, it is seldom necessary to use any great effort. The casing is kept loose by the rotation of the casing while the hole is sunk, and it is also loosened by the same means during the pulling. The casing is usually removed at a rapid rate, and generally only part of the crew is needed. It is then customary to use the other men in preparing for and starting a new hole. This also increases the aggregate speed.

Accuracy of Core

The core secured by means of this drill is probably more accurate than that of any drill that uses driving methods to sink the casing. Much has been said of the tendency of material to be forced away from the drive shoe. This is particularly likely to occur in drilling alluvion which has hard and soft strata in juxtaposition. The drive pipe, in passing from a hard to a loose stratum is likely to contain several inches of hard core, or possibly a boulder the full size of the pipe, and to force the loose gravel out of the path of the shoe, and thus material properly belonging to the core will be driven away. Hard and soft strata are encountered in an irregular way in nearly all gravel deposits.

"Running ground" is fine gravel or sand with a large amount of interstitial water. It is likely to run into the casing of a drill hole, and to make a core of many times the depth represented by the distance sunk. When, in either driving, drilling, or pumping, such material is encountered, there are several reasons why the occurrence is much less likely to introduce errors when the casing is rotated. The prime benefit of rotating is in keeping the casing loose. When running ground is encountered, the casing usually sinks into it to such a depth that sufficient core accumulates to prevent running in, or the casing may penetrate entirely through the stratum to a harder layer of material underneath.

Another matter also tends to prevent difficulty. Running ground is, of course, only encountered where there is water to make it run, and it will not run into the casing unless there is considerable difference in the water level of the gravel and the water level inside the casing. The steam churn drill in general has a core in the casing indurated by driving, and this acts as a plug to prevent water from running into the casing; the sand pump removes the water from the casing. Therefore, there is generally hydrostatic pressure at the lower end of the casing tending to wash material into it; when loose material is encountered this water flows in and tends to carry material with it.

The hand drill here described has no such plug, and one effect of rotating the casing is to keep the core loose. Thus water generally flows in freely and to such an extent that the water level in the casing is not much, if any, lower than that of the alluvion outside the casing; for it runs in about as rapidly as it is taken out by the pump. Then also the pumping operation is generally carried on constantly, and there is no action parallel to that of the sand pump of the steam drill. The sand pump of the steam drill is used occasionally, and since it is about 8 ft. long and 4½ in. in diameter, it then lifts a comparatively large amount of material and water. The pump of the hand drill pumps at a slower rate, but continuously.

Mobility

A hand-drilling outfit for use with rotated casing when equipped to drill 30 ft. weighs about 1000 to 1200 lb., and it sectionalizes into one-man packs with a minimum weight of less than 75 lb. No part is bulky; it can, therefore, be transported comparatively easily under extremely difficult conditions. Only one part of the outfit, the platform, needs knocking down for long transport; it is not essential to do this for moves of moderate length, for it weighs only about 200 lb., and can be slung on a pole and carried by two men. In moving from hole to hole in the same area, the platform is easily moved by rolling like a wheel.

The whole outfit can be carried through tropical swamps and jungles, or in small canoes. In one case it was moved through the jungle where we had no trails but the lines for surveying not opened more than necessary for sighting. It was also moved over swampy areas where the men were constantly ankle-deep in a sticky mud, and where it was also necessary to use light corduroy at the working place. It was transported in small canoes over rapids so shallow that it was necessary to drag the canoes when descending as well as ascending. Streams too deep to wade were passed by felling trees for use as bridges, the men steadying themselves with long sticks while carrying the drill parts. Extremely steep hills were negotiated on narrow, rocky trails by the bare-footed men who did the packing. These instances are merely cited to indicate what may be done with a hand drill and to emphasize the advantage of its great mobility. It would have taken more time and money even to transport a steam drill to this area than was spent on the total examination with the hand drill.

Rate of Operation

In one instance the drill was used in alluvion from 16 to 32 ft. deep. The gravel contained boulders about 12 in. thick on the larger axis. Cemented lumps, fragments of laterite, agglomerated in the oxidation of iron by water containing much humic acid and vegetable matter occurred, in some instances 3 ft. or more in diameter. The gravel was of a fine to

medium size and sandy to sticky. An average of more than 16 ft. of 5-in. hole per shift of 8.5 hours was made at a cost of about 50c. per ft. for operation. The cost of labor was about $1 per day. Much work is said to have been done by the Dutch government in shallow alluvian, about 10 to 15 ft. deep, at the rate of 45 ft. or more per day at a cost of less than 25c. per ft. drilled, the cost of labor being $1 per day.

Steam or Hand Drill

As a general rule, where skilled labor, fuel, water, repairs, etc., are cheap, and the conditions are such that the steam drill is easily moved, and where indurated gravel and large boulders are found, it is preferable, in consideration of operating cost, to use the heavier power machine. There are many placer deposits in inaccessible regions, where fuel and water are costly and others in which the expense for imported skilled labor would be heavy, and where transport to and over the area investigated is difficult. Repairs may be a serious matter where machine shops are not accessible. Under such conditions the hand drill is preferable. Hostile environment, inaccessibility, bad climate and poor labor that make steam drilling costly may not affect the cost of hand drilling so seriously as that involving the use of a heavier machine. Wherever a supply of cheap, unskilled, accliminated labor is available, cheap work can be done with the hand drill under the conditions mentioned above. No fuel and little water are needed, and transportation, even over surfaces almost impossible for the steam drill, is not a matter of particular difficulty. The expense for repairs and renewals is very small.

First Cost

The first cost of a hand-drilling outfit is less than one-half that of a steam drill. When the investigation involves difficult transportation to distant areas, or where roads are in bad condition, or there are no roads at all, the difference in the respective cost of the drills laid down on the ground is much greater. Some areas practically inaccessible to the steam drill may be tested with a portable drill at a moderate cost. The first cost of a hand drill landed on an area may be so much less than that of a steam drill, that high operating costs for labor, such as are noted in Alaska, may be more than compensated. As a general proposition where wages are high, there are bad transport facilities for a steam drill, high wages being often the direct result of poor transport; so the gain of using fewer men is really less than it may seem, when the lost time and difficulties of transport concomitant with steam drilling are considered.

Inasmuch as the steam drill and equipment weighs about 15 times that of the hand drill with rotated casing considerations of transport are very important in making a choice between the two machines.

A hand drill using 6-in. casing cannot generally be used advantageously to a depth of much more than 100 ft. without using spring poles or other devices. By using smaller casing greater depths may be reached. A hand drill cannot penetrate hard material as rapidly as a steam drill, nor can it operate as well in large and hard boulders. The steam drill actually drills more rapidly when set up and at work, but when considerations of lost time through moving, setting up, breakages, repairs, adjustments, bad weather, waits for fuel and water, etc., are included, and the aggregate results are compared, the hand drill may show more work at a less cost per foot than the steam drill. Of course, the conditions peculiar to the area being investigated govern these results, but there is unquestionably a large field where the hand drill can be used advantageously.

The advantages of a hand drill are principally those of great mobility and accurate results, but the cost of operating is almost all for labor; repair and renewal expenditures are so small that they are practically negligible. I operated one where there was no blacksmith outfit. I did what little sharpening was necessary on a grindstone. A hand drill can be operated more constantly in stormy weather, and in heavy rainfall. I operated while the daily rainfall was more than one in. There is very little lost time. When this feature is compared with the large time losses in steam drilling, it is obvious that, even though the steam drill operates more rapidly while actually at work, the hand drill working constantly, though more slowly, may, in the aggregate, drill more feet in a given time than a steam drill and at a lower cost.

The St. George Amalgamation-Cyanide Mill

Those familiar with mining conditions in the West Australian goldfields will be interested in the description (*Australian Mining Standard*, Sept. 30, 1908) of a plant erected by the Boulder No. 1 Company on the St. George mine at Mount Magnet. The scheme of milling differs in some respects from that common in the northern fields of the region and for this reason merits attention. The method adopted to render mineralized mine water fit for boiler use is also interesting.

The process of milling, a combination of amalgamation and cyanidation of slimes, is somewhat similar to the practice in several of our western regions. The ore, which is practically all mined from the oxidized zone is crushed, milled in stamp batteries in weak cyanide solution to pass through coarse screens and then run over amalgamating plates. These are of copper, 12 ft. long with a drop of 1¼ in. to the foot. Thence the pulp is run into Wheeler grinding pans where it is all slimed to 150 mesh or finer sizes. The grinding pans, four in number, are arranged in tandems, two to each five stamps. The pulp is then pumped into condensers consisting of a nest of nine inverted pyramidical spitzkasten 6 ft. square and 6 ft. deep, where it is thickened in the underflow to a specific gravity of about 1.45. The overflow from these settlers goes to the battery supply tank.

The slime is agitated with cyanide solution and then gravitates to a mixer used to feed the filters under a constant head. Two Ridgway vacuum filters are used, the cake being mixed with mine water and pumped away, the gold solution going into zinc boxes for extraction. The zinc boxes are of the usual type. The spent solution is elevated and drawn off to the wash tank of filters to the battery supply tank or to the strong solution tank, as needed.

Power Plant

In connection with the power generation the water softener is of especial interest. A 105-h.p. producer gas engine provides all power for the plant except for the crusher and pumps. For these a steam engine is used, the steam being generated in Cornish boilers from mine water previously treated to remove impurities. These impurities consist principally of salts of lime, magnesium and sodium with some aluminum silicate and organic matter. The water softener precipitates and removes these harmful calcium and magnesium salts, which would otherwise form scale in the boiler. This is automatically accomplished by introducing soda ash into the boiler supply in the proper proportions to precipitate any calcium or magnesium present as sulphates. The equation expressing this is:

$$MgSO_4 + Na_2CO_3 = MgCO_3 + Na_2SO_4$$

The precipitated insoluble carbonates are removed by filtration through wood wool. Then by utilizing exhaust steam to raise the temperature of the water the soluble acid carbonates of lime and magnesium are decomposed into water, carbon dioxide, evolved as gas, and into the insoluble normal carbonates which are again removed by filtering through wood wool. The reaction in this last case is of this nature:

$$CaH_2(CO_3)_2 + heat = H_2O + CO_2 + CaCO_3$$

This plant was designed and erected under the supervision of W. G. Manners, of Kalgoorlie.

Air-hammer drills are being tried in stopes at Butte, Montana. The small or "chippie" piston drills have never been a success at Butte, partly owing to the miners' prejudice against them. Another peculiarity of Butte practice is the use of tripods for the machines in many stopes.

Tungsten Ore Deposits of the Coeur d'Alene

Scheelite Occurs Associated with Gold, Silver, Lead, Iron and Copper. Ore Carries 25 Per Cent. Tungsten Trioxide. Deposits Undeveloped

BY HERBERT S. AUERBACH*

In the early days of gold excitement in the Cœur d'Alene, prospectors occasionally brought in fragments of a very heavy and brittle brown rock. This was generally assayed for gold, silver, or lead, and upon yielding no returns for these metals, was cast aside as worthless. About 10 years ago this heavy brown rock was found to be scheelite (calcium tungstate), and since that time the deposits near Murray, Idaho, have aroused widespread interest among tungsten-steel manufacturers, and many exceptionally fine specimens have found their way to museums in the United States and Europe.

So far scheelite has been found within a circle of about three miles radius, taking Murray as the center. Its principal occurrence is in the Golden Chest mine and in the Golden Winnie property, but it has been found in other places in small quantities. In the days of the gold rush, a German prospector uncovered a 2-ft. vein in Pony gulch; because of the great weight of the mineral he mistook it for an ore of lead, but when an assay showed none of that metal, he abandoned the vein, which has not been rediscovered. During placer operations in Trail and Pony gulches, scheelite was frequently found on the bedrock, and in Eagle and Tributary gulches it is washed into the sluice boxes. Dunlap and Smith, while placer mining in Eagle creek, uncovered a small vein near the Columbus group.

Golden Chest Mine

In the Golden Chest mine tungsten is found in the Klondike shoot on the Katie and Dora vein. The Klondike, a shattered and mineralized zone about 150 ft. in length by about 40 ft. in thickness, is in many ways an exceptional orebody, and has produced large quantities of rich gold ore. The main Klondike fissure varies from 1 to 20 ft. in thickness. It strikes east-west, and varies in dip between 25 and 55 deg., averaging about 38 deg. Both the hanging- and footwalls are well defined, and consist of black slate. In places a narrow gouge follows along the hangingwall. The country rocks are slates and quartzites. The gold and tungsten were introduced by an intrusion which appears to have been originally a syenite, but owing to metamorphism, it is practically impossible to classify it with exactness. It often occurs as a fine-grained rock resembling quartzite, but in some portions of the vein it shows a porphyritic structure.

The vein filling is bull quartz and ribbon quartz, with abundant iron pyrites and less amounts of chalcopyrite and galena. The scheelite is found in a shoot about 75 ft. long and has been followed to a vertical depth of approximately 350 ft., at which depth its size appears undiminished. In one place there are 5 ft. of excellent shipping scheelite, but the greatest thickness of pure mineral is 3 ft. In another portion of the vein, the concentrating ore is 15 ft. wide.

While the scheelite is found in a well defined shoot, the bodies themselves are irregular, pinching down to streaks, branching out into numerous veinlets, and again uniting to form large and solid bodies. The scheelite is, however, practically continuous from the surface to the lowest level. The ore is rather difficult to save, because of its excessive brittleness. So far about 50 tons of high-grade ore have been extracted, but only 15 tons of this were saved, the remainder having been thrown on the dump before it was known to be of value.

The analysis of ore consisting of quartz, sulphides and scheelite was: Au,. 0.56 oz.; Ag, 0.22 oz.; WO_3, 25 per cent.; Pb, 12 per cent.; Fe, 6 per cent.; Cu, 2 per cent. The sulphide concentrates contained Au, 6.84 oz., and Ag, 2.91 oz. Tetrahedrite analyzed Au, 0.08 oz.; Ag, 34.20 oz. and Cu, 8.3 per cent. Four samples of scheelite showed 78.20, 76.59, 60.75 and 30.40 per cent. WO_3, respectively.

Character of the Mineral

The shipping ore is found as pure scheelite, and as scheelite with small stringers of snow-white quartz disseminated through it; also as scheelite intimately associated with a variety of sulphide minerals, such as iron pyrites, chalcopyrite, galena, sphalerite and tetrahedrite. The concentrating ore consists of pieces of scheelite, varying in size from a pin head to a walnut, shot through a gangue of quartz and quartzite. The quartz, however, is the distinctive gangue.

So far only one specimen showing native gold lying directly upon scheelite has been found (Fig. 1). Although free gold and telluride gold occur in the immediate vicinity of the scheelite, they appear to be associated with the sulphides, and not with the scheelite. An interesting specimen is shown in Fig. 2, where the scheelite occurs as a yellowish-brown filling in the cells of honeycombed milky quartz, the scheelite greatly resembling small cubes of American cheese. A section broken from the vein just below the

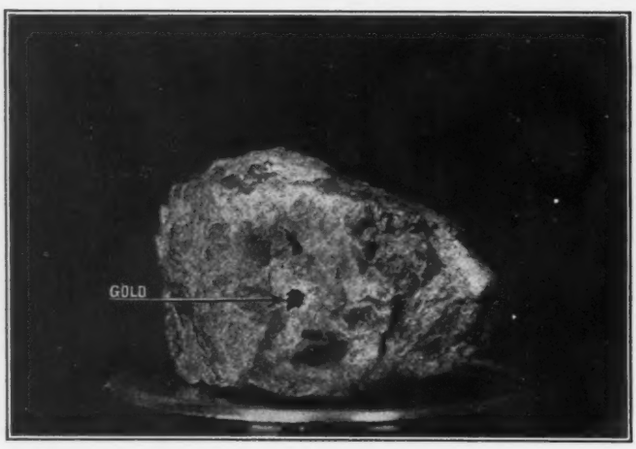


FIG. 1

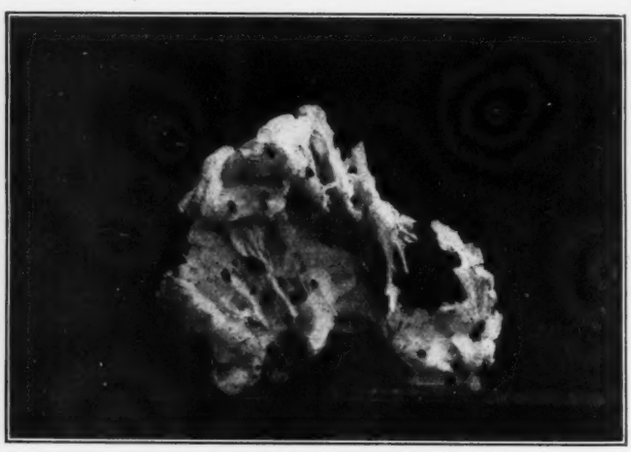


FIG. 2

*General manager, United Golden Chest Mines and Milling Company, Murray, Idaho.

hanging wall is shown in Fig. 3. On the top is slate and below this is quartz, showing iron pyrites at one end and scheelite at the other. In Fig. 4 are sulphides of iron and lead, spattered in the midst of solid scheelite. Fig. 5 shows the crystalline structure of scheelite. It is the best crystallized specimen that has been found in the district. Fig. 6 is a scheelite specimen weighing 62 lb., consisting practically of solid mineral.

The Golden Winnie Mine

At the Golden Winnie or Arrastra Smith property, on the south bank of Prichard creek, two miles west of Murray, the scheelite also occurs in conjunction with gold ore. The vein strikes east-west with a 45-deg. dip, and varies from 6 in. to 3 ft. in width. The hanging wall is slate and the footwall quartzite. As in the Golden Chest the gold- and tungsten-bearing solutions were introduced by an eruptive which has been greatly altered by metamorphism. No great depth has been attained on the vein, but considerable concentrating scheelite has been exposed and several tons of the mineral are on the dump. While most of the scheelite in this property is of concentrating grade, occasional kidneys of shipping ore are encountered. The vein is badly shaken up and twisted, but the scheelite ore is persistent although the bodies are irregular. Ribbon rock carrying gold often accompanies the scheelite. Edwin Higgins, a mining engineer who examined tungsten deposits in this district, found barytes associated with the scheelite in some parts of the Golden Winnie mine. To my knowledge the association of these two minerals has not been noted in any other tungsten deposit of the United States.

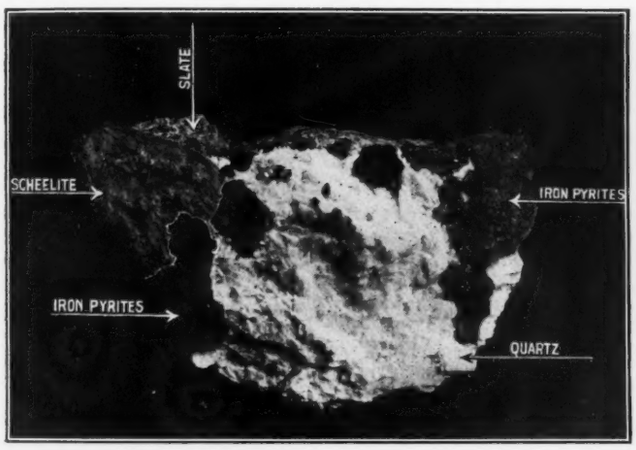


FIG. 3

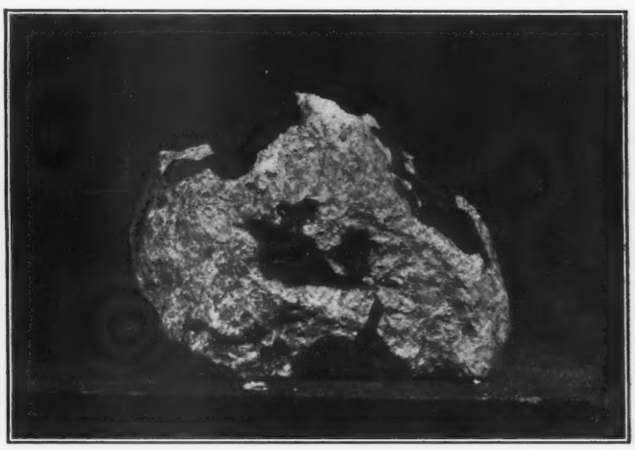


FIG. 4

Mineralogy

The scheelite of the Murray district is of a brown color. The crystallization is tetragonal, but it is difficult to find crystallized specimens, because the mineral generally fractures in an irregular manner, exposing many sharp edges. It is extremely brittle, breaking into a powder which looks like corn meal. After exposure to the air for a time, its brittleness diminishes slightly. It gives a white streak and is nonmagnetic. The Golden Chest scheelite has a hardness of about 4.8 and a specific gravity of 6.1. Its luster varies from translucent to adamantine, and resembles many minerals of the silica group.

Theoretically scheelite consists of 80.6 per cent. WO_3 and 19.4 per cent. CaO, but the best mineral in the Murray district assays 70 to 78 per cent. WO_3. No manganese or molybdenum has ever been found with the scheelite.

Chemistry

All the commercial tungsten minerals are derivatives of tungsten trioxide (WO_3), a bright canary-yellow powder. In a reducing atmosphere the trioxide changes to dioxide, a brown-colored powder, and finally is reduced to dark gray metallic tungsten. If the mineral is fused in a salt of phosphorus bead and the bead is then powdered and dissolved with tin and an excess of hydrochloric acid a deep blue solution is obtained.

Probably the simplest quantitative analysis of scheelite is by the Wohler method as follows: Crush the scheelite to a fine powder and digest with concentrated nitric acid, evaporate nearly to dryness, mix with alcohol and filter. The precipitate is yellow trioxide. Wash with alcohol, ignite and weigh. Evaporate the solution until the alcohol is expelled, neutralize with ammonia and precipitate the lime with ammonium oxalate. Dry and weigh.

Milling of Scheelite Ores

If the tungsten is to be alloyed with steel, the sulphides must be removed, since 0.05 per cent. or more of sulphur causes red-shortness in steel. Although the electrostatic machine has successfully separated sulphides from hübnerite, attempts to separate sulphides from scheelite by electrostatic means have so far proved unsuccessful.

In the Golden Chest mill, the gold ore accompanied by scheelite was crushed in a Blake crusher, stamped to 40 mesh, passed over amalgam plates to Wilfley tables and thence to Johnson vanners. The scheelite scoured the amalgam plates and was an annoyance.

One of the greatest difficulties to contend with in milling scheelite is its tendency to slime. In the Golden Winnie mill a Dodge crusher was used on tungsten ore for a short time with fair result. Up to date, however, no serious attempt has been made to concentrate scheelite ores in the Murray district.

Metallurgy

It is difficult to obtain trustworthy information concerning commercial reduction processes, which, as a rule, are carefully guarded secrets. The successful method is to heat the finely ground mineral in mixture with carbon to above 1500 deg. C., when the trioxide is reduced to metal and the iron, manganese, calcium and oxygen combine with the carbon. Several commercial processes for reducing ore and forming alloys in the electric furnace have been devised.

Uses

Although classed among the rare metals, it is surprising to what extent tungsten is used in the industrial world. In some form or other, it is alloyed with practically all the metals. It finds, however, its greatest application as an alloy of steel, to which it imparts many valuable properties. Foreign metallurgists were the first to recognize and take advantage of this fact. Tungsten toughens steel plate, and renders it less liable to fracture, thus making it highly desirable for the production of armor plate, projectiles and firearms. High-speed tungsten-steel tools retain their temper while red hot. The addition of tungsten to steel car-springs increases their stiffness. Tungsten steel retains magnetization for a longer time than ordi-

nary steel, and is much used in the manufacture of electrical apparatus. Alloys of aluminum, tungsten and copper possess great lightness and strength, besides unusual resistance to oxidation. They are used for making novelties, cooking utensils, automobile parts, boat propellers, etc. Filaments of tungsten compounds are finding extensive application in incandescent lighting. They give a superior light to that of the carbon filament, and consume less electrical energy. A bronze powder much used in decorating is made by fusing potassium tungstate and tin. The salts of tungsten are prized as coloring agents in the glass and porcelain industries, while lead tungstate is employed as an adulterant in pigments. Cloth and wood when coated with a solution of sodium tungstate, glue and hydrochloric acid are rendered fireproof. Sodium tungstate also finds application as a mordant in dyeing wool. The fluorescence of calcium tungstate is employed to advantage in the fluoroscope.

Prospecting for Phosphate Rock

By Francis F. Wilson, Jr.*

While installing a gasolene engine in a tow-boat on the Coosaw river, near Beaufort, S. C., I saw an odd way of prospecting for phosphate rock. This tow-boat, belonging to the Central Phosphate Company, of Beaufort, S. C., was used to serve two phosphate dredges digging rock from the bottom of the Coosaw river, and to convey the dredged and washed rock from the dredge to the mill five miles away. The dredges were of the usual type, with ordinary dip or scoop bucket, and fitted with two spuds for anchoring them when they were dredging. The phosphate rock, which is found at the bottom of the river at various points in flat layers of broken surface and of varying hardness and formation, is full of fossils of various kinds, and yields much bone phosphate. The crude rock is of dark grayish appearance, somewhat resembling limestone.

The beds are irregularly scattered along the river bottom in varying quantity; the manner of locating these beds of rock is interesting. The dredgemen are paid for the output of rock on the tonnage basis, and their working capacity is dependent upon the ability of the "sounder" to readily locate new areas of rock. The most skilful of these sounders that attracted my attention was an old hunchback negro known as Esau. Whenever a bed of rock was almost exhausted, Esau would get into his skiff and start to "sound" for rock by dropping into the river a tightly corked quart-size flask filled with water, and attached by the neck to a light cord or fish line, the free end of which he held to his ear. The bottle gradually descended to the bottom, and the string readily transmitted the vibrations caused by the bottle's striking any rock or other bodies on the bottom of the river, the end of the string being held as far within the ear as possible with the finger. By means of the sound, Esau could tell the quality and judge the thickness of the rock.

After outlining the area of the bed with floats formed by wooden sticks attached by a line to stone anchors, Esau would go over the area thus covered and test for the thickness of the rock by means of his bottle and string, but in order to do this he attached to the end of the string a heavy cardboard disk or diaphragm, about 3 in. diameter. This diaphragm he held to his ear in much the way that a telephone receiver is used.

The ability of this man to locate rich and heavy beds of rock was really marvelous, as he invariably mapped out the actual area covered by the rock and accurately designated the thickness or depth of the phosphate rock at various points in the area.

When the phosphate industry was in its infancy several years ago on the Coosaw, there were no less than 25 dredges operating on the river within a length of 10 miles.

*104 Woodland avenue, Coatesville, Penn.

Diamond Production in South Africa

Special Correspondence

Some interesting statistics regarding the diamond industry in South Africa were given by the London *Financial News* in its issue of Nov. 17. These statistics record a remarkable increase in the production during late years, which accounts no doubt for the financial difficulties of the diamond companies. The statistics do not claim to be complete but are probably within 5 per cent. of the total production. The figures include the output from the following mines: De Beers, New Jagersfontein, Koffyfontein, Lace mine, Frank Smith mine, Kamfersdam, Premier, Roberts Victor and Voorspoed. The production for 10 years has been, in carats:

	Carats.		Carats.
1898	3,025,039	1903	2,607,024
1899	3,261,135	1904	3,450,631
1900	1,435,689	1905	3,498,368
1901	2,532,955	1906	3,508,210
1902	2,650,193	1907	5,002,968

The increase in recent years has come from the Premier mine in the Transvaal, which is now the great competitor of the Kimberley mines of the De Beers company. The Premier first became a large producer in 1904, and its output since then has been: 749,643 carats in 1904; 845,642 in 1905; 899,746 in 1906; 1,889,937 carats in 1907. The increase was gradual until last year, when the output was more than doubled.

The Premier company is putting up a plant capable of washing 40,000 loads a day. Taking the average of 0.289 carat per load—shown in the report for 1907—this would give 11,560 carats per day; or for 300 working days 346,800 carats yearly. The average price now secured by the Premier company is stated to be $3.36 per carat.

FIG. 5

FIG. 6

The James Slimer

By M. T. Hoster*

The great problem in ore concentrating at present, one which is becoming more important every day, is the proper and economical handling of slimes, the finer particles of mineral-bearing pulp. It was with this end in view that the James concentrating table was designed. The general features of construction of this slimer are shown in the accompanying illustration in plan and side elevation. The entire table is about 31 ft. long; it is supported on an open steel frame by means of 44 flexible carriers, and is given a backward and forward bumping motion, of 9/16- to 5/8-in. stroke, by means of an adjustable toggle-joint arrangement, as shown at the extreme left.

The table deck is divided into four working sections, i.e., a longitudinal settling section, a stratifying section, and two finishing sections. The first 18 ft. from the left end of the table constitutes the settling section, a new departure in tables of this class. It is a smooth, flat and slightly inclined linoleum surface 3 ft. wide, with a pulp distributer fastened to its upper end. Directly behind this settling section is the stratifying basin, 5/8 in. deep, 7 ft. long and gradually decreasing in width and depth toward the lower end. The bottom of this basin is provided with centrally diverging parallel riffles 1/4 in. deep and 2 in. apart. It is at the beginning of this basin that the material is divided into two equal and similar parts, both to be worked in the same manner, but entirely separate. This gives the table a large capacity. The two finishing sections constitute the remainder of the table, one section being hinged to each side of the stratifying section, and both transversely adjustable by one adjusting lever. The surface of each is of linoleum with riffles decreasing in hight toward the lower end, and bent along a definite line, as shown.

*Park City, Utah.

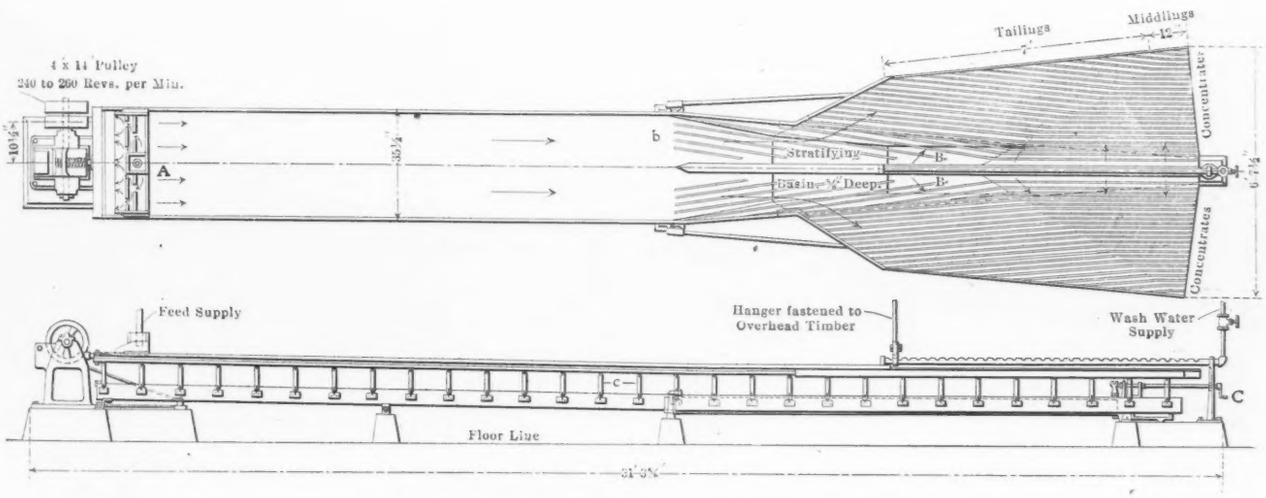
Method of Operation

The thickened pulp of fine particles is delivered into the feed distributer, and is equally distributed transversely across the head end of the table, or settling section. The pulp and slime water slowly flow down the incline, but due to this forward motion combined with the bumping motion of the table, the heavier particles of material gradually collect below and the slime water becomes disturbed just sufficiently to allow the slimes to settle.

On entering the stratifying basin the slime water, which is now clear on the surface, is divided into two streams and flows off over the two finishing sections, while the solid material is retained in the deep basin. The particles of greatest specific gravity will now move along the centrally diverging riffles and toward the center of the table, and, therefore, away from the lightest particles, which will move as shown by the long arrows.

The particles of intermediate specific gravity will move along a path midway between these extremes. By this method the values are most advantageously consolidated and stratified while in a deep basin, practically free from any water currents. As the mineral travels up the inclined and farther end of the stratifying basin it gradually spreads out on the finishing surface and is washed by the dressing water in the usual manner, without any loss of fines. From here on, the mineral follows out the line of the riffles, as is the case in various other types of tables, but as the material on this table has been fully prepared, besides saving the fines, this final separation will be most effective. The concentrates are discharged over the end of the table while the middlings and gangue flow over the two sides as shown in the plan.

This slimer has been in successful operation for some time at various mining camps, including: Bingham Cañon, Utah; Santa Barbara, Mexico; Alaska, and Montana. The table is undoubtedly rather long, but compared with its capacity it requires little space. About 6 gal. of wash water are required per minute at a maximum, depending upon the character of the ore.



PLAN AND ELEVATION, JAMES SLIME CONCENTRATING TABLE

Copper Smelting Suits in California

Special Correspondence

The Keswick smelter case has come to an end. This was the case of the United States against the Mountain Copper Company, of Shasta county, California, in which the Government sought to obtain an injunction against the copper company and prevent it from operating its smelter at Keswick because of injurious effect on timber lands by the fumes. The copper company had many suits pressed against it by local people and bought up many thousands of acres of land in trying to avoid possible litigation. The most pressing suit was that brought by the Government. The Government timber tracts lie many miles from the smelters, in the Pit river section and that of eastern Shasta, and the injury done was doubtful, to say the least. Much expert testimony was used in the case and there was much difference of opinion as to possible damage by smelter fumes. Finally by stipulation between the copper company and the Government the case has been dismissed. But during the long period since the institution of the suit the company has been put to much trouble and expense, which finally ended in the closing down of the smelting plant at Keswick and putting up another one on the shores of San Francisco bay above Martinez. This action was detrimental to the mining interests of Shasta county.

Stripping Clinton Iron Ore in New York State

20 Feet of Over-burden Removed to Mine a 22-inch Bed of Ore; Waste Bank Carried Sixty Feet High by Means of Conveyer System

BY EDWIN HIGGINS

Within the State of New York the rocks of the Clinton formation, embracing shales, sandstones, limestones and layers of iron ore, appear at the Niagara river, near Niagara Falls, and extend for a distance of about 225 easterly, thinning out and disappearing in Otsego county. In Niagara, Orleans and Monroe counties on the west, and Otsego county on the east, the outcrop is comparatively thin, owing to the steeper dip of the strata, but in the eastern part of Wayne and in Madison and Oneida counties, where they lie almost flat, the formation reaches a width of from four to five miles. From Rochester on the west to the town of Clinton on the east the dip may be said to vary between 40 to 150 ft. to the mile. The dip throughout is toward the south.

In Wayne county, where the outcrop lies only a short distance from Lake Ontario, the iron-ore beds lie only a few feet above the level of the lake, which is about 246 ft. The maximum elevation is reached in Oneida county, the highest point being about 1400 feet.

The Ore

The hematite beds are the essential features of the formation. The overburden varies, as indicated by the dip of the strata, being lightest along the northern border and increasing slightly toward the south. The minable ore varies from 20 to 36 in. in thickness. The ore is a red hematite, both the fossiliferous and oolitic varieties being found. In general they may be said to have the following range of composition: Iron, 35 to 45 per cent.; silica, 5 to 15; alumina, 3 to 8; lime, 6 to 12; magnesium oxide, 2 to 6; sulphur, trace to 0.4; phosphorus, 0.2 to 1.

Mining up to the present time has been prosecuted chiefly along the northern border of the deposits, where the overburden is comparatively light. Although the deposits were discovered at an early date, probably before the year 1800, it was about 25 years afterward that mining operations began with any degree of regularity. During the last few years the output has averaged about 75,000 tons per year. In 1907 it was over 100,000 tons.

For a complete geological and historical discussion of these deposits reference should be made to Museum Bulletin 123, "Iron Ores of the Clinton Formation in New York State," by D. H. Newland and C. A. Hartnagel. The above brief outline is given only as an introduction to the main subject of this article, i.e., the stripping operation conducted at Ontario Center, Wayne county, where the overburden is about 20 ft. in thickness and the ore from 20 to 22 in. in thickness.

Furnaceville Iron Company

The Furnaceville Iron Company owns a large tract of ore land and mineral rights in the vicinity of Ontario Center, Wayne county, about 15 miles northeasterly from Rochester. Here the ore comes to the surface about 1¾ miles south of Lake Ontario. The dip was not determined accurately, but it is probably not more than 40 ft. to the mile. In the present workings the overburden is about 20 ft. in thickness, 10 ft. of which is limestone, more or less shaly, the upper part being soil and glacial material. The ore varies from 20 to 22 in. in thickness, and has the following range of composition: Iron, 38 to 45 per cent.; insolubles, 11 to 16; calcium and magnesium oxides, 10 to 15; phosphorus, 0.4 to 0.6; manganese, trace to 0.05; sulphur, trace to 0.02. Most of the ore is shipped to furnaces at Em-

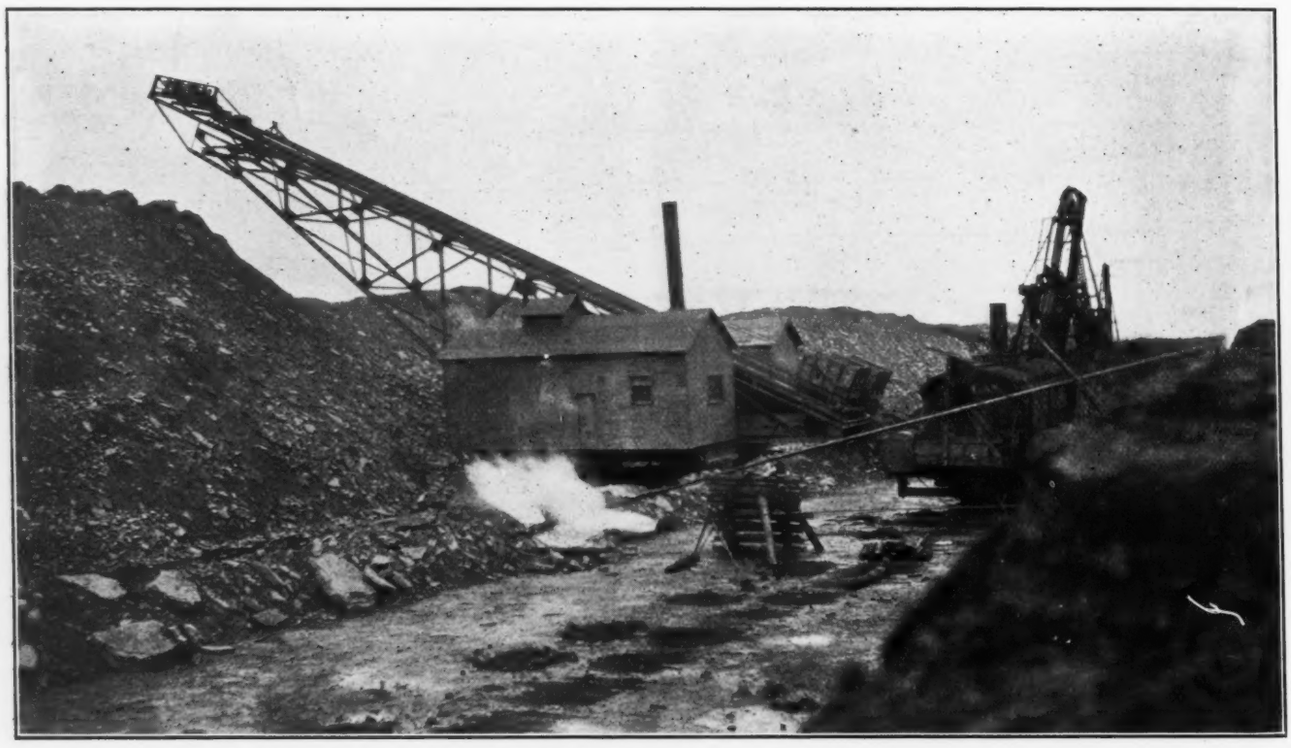


FIG. 1. STEAM SHOVEL WITH CONVEYER USED IN DISPOSING OF WASTE

porium, Penn., although a small amount is marketed to paint manufacturers.

Early Work

Mining operations were conducted here over 30 years ago. Work was started where the overburden was lightest and the methods used were rather crude, wheelbarrows being used to remove the dirt. At one time the ore was smelted in blast furnaces at Furnaceville, the pig being shipped by way of Lake Ontario.

Up to the time when the present equipment was installed, a little over a year ago, the stripping was done by two Boston steam shovels, made by Souther & Co., of Boston. These shovels were operated more or less continuously for a period of 20 years, and, although somewhat antiquated, they are still used for special work.

Method of Mining

The mining operations, as conducted with the old Boston steam shovels, were simple, and do not differ from the practice today, except that more modern machinery has been installed for handling the dirt. A cut is carried through the overburden, exposing the ore. When the old Boston shovels were used this cut was carried 60 ft. in width, each shovel taking 30 ft. At present the cut is about 40 ft. wide, although the shovel in use is capable of taking 56 ft. The waste material is disposed of, as will be explained below, and the ore is broken and loaded into railroad cars on the bank. A spur from the Rome, Watertown & Ogdensburg railroad is carried within a few feet of the cut. When the cut has been carried as far as desired, another one is started, the railroad tracks are moved back, and the work progresses as before.

The overburden, before being removed by the steam shovel, is drilled and blasted, 6-in. holes being put down with churn drills. Two of these drills are shown at work in Fig. 5. These holes are drilled at 15-ft. centers and extend a few inches into the ore; they are loaded with from 50 to 80 lb. of 40 per cent. dynamite.

The steam shovel (see Figs. 1 and 3) discharges its load into two 5-ton skips, which stand at the bottom of the conveyer, shown in Fig. 1. These skips are hoisted to the discharge end of the conveyer, where the rock is dumped onto the waste bank. At the time of my visit this shovel and conveyer were not in operation, the men being engaged in breaking and loading ore in another section of the cut, shown in Fig. 2. By the use of the conveyer the waste bank is carried about 60 ft. in hight.

Removing the Ore

The operation described above disposes of the waste material, with the exception of about 8 in. of limestone capping over the ore. This capping adheres persistently to the ore and is usually blasted, although it may sometimes be removed with crowbars.

Holes are drilled through the ore at 3-ft. centers, charged with from 1½ to 1¾ sticks of 17 per cent. dynamite, and blasted. The ore breaks in slabs of varying sizes, the large pieces being broken with sledges. The broken ore is loaded into tubs by a smaller steam shovel, and hoisted by means of a derrick into railroad cars on the bank. In Fig. 2 the men are seen loading the ore by hand into the tubs. This is contrary to the regular custom; the work shown was being done at a point some distance from the main operation, as noted above. It was not practicable to move the ore shovel up for this work.

Equipment, Labor, Fuel, etc.

Two churn drills, made by the Austin Manufacturing Company, of Cleveland, Ohio, are used for loosening the overburden. Each drill requires one man and burns about 400 lb. of coal in 10 hours.

The derrick for loading ore requires a crew of three men, and burns about ¾ ton of coal in a 10-hour day. For stripping, a Vulcan giant steam shovel of 2½-yd. dipper capacity is used. This requires a crew of three men and consumes three tons of coal per day of 10 hours.

The conveyer in use, which was made by the Dobbie Foundry and Machine Company, of Niagara Falls, N. Y., is of interest in that the amount of waste handled has been greatly increased since its installation. The incline is 129 ft. in length. The skips are self-dumping, of 5 cu.yd. capacity, and can be hauled to the top of the incline, dumped and returned in 30 seconds. Of course, this speed cannot be maintained in ordinary work. While one skip is being dumped, the other is in place for loading.

This conveyer is equipped with a boiler and a 50-h.p. double-drum hoisting engine; each drum works independently of the other. There is also a steam winch

FIG. 2. BREAKING ORE AND LOADING INTO RAILROAD CARS WITH DERRICK. OLD BOSTON STEAM SHOVEL SHOWN TO LEFT

for moving the machine forward. This is accomplished by attaching a rope to a "dead man" and winding by means of the winch. In the operation of the conveyer four men are required; one fireman, one hoisting engineer, one man for winch, and one topman. The coal burned is two tons per day of 10 hours.

The ore shovel is a Vulcan little giant of 1¼-yd. dipper capacity. It requires a crew of three men and burns 1½ tons of coal in 10 hours. With the aid of this shovel, as much as 300 tons of ore have been broken and loaded in one day.

In arriving at these figures I have reckoned the labor costs per day as follows: Foreman, $3.50; shovel runner, $2.50; craneman, $2; fireman, $1.75; laborers, $1.30. Coal is reckoned at $3.50 per ton. It is probable that labor costs will vary slightly from these figures in different parts of the district.

Of course, the amount of material which a shovel of 2½-yd. dipper capacity can handle in 10 hours varies greatly, depending on the nature of the overburden and the facilities for disposing of the same. In the case under discussion the facilities for disposing of waste being good, 2200 yd. should be removed in 10 hours. This would correspond to an ore production of 50 tons per day, at a cost of $1.50 per ton. Under adverse conditions the yardage of overburden removed should not fall below 1800; under the most favorable conditions, on the other hand, even better than 2200 yd. could be accomplished.

In general, it may be said of mining the thin seams in this district, under an overburden of 20 ft. or more, that it would be well to carefully compare the cost of mining by stripping with that by underground methods. Where the orebed approaches 3 ft. in thickness, the above figures are subject to amplification.

FIG. 3. VULCAN GIANT SHOVEL, WHICH IS MAKING A 40-FT. CUT; OVERBURDEN, 20 FT.

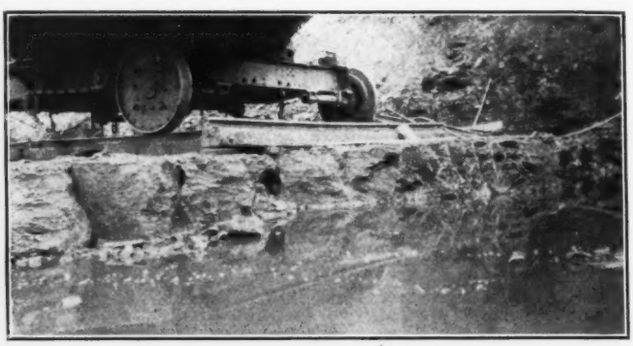


FIG. 4. FROM 20 TO 22 IN. OF ORE EXPOSED AND READY FOR BLASTING AND LOADING

In addition to the men, most of whom are Americans, required to operate the machines mentioned above, there are employed in and about the cut from 10 to 15 Italians for general work. One shift of 10 hours is worked, except in winter, when the shift is cut to nine hours. Work is prosecuted all through the winter, except in case of very severe weather.

Capacity and Cost

Little information was obtained as to production and cost of mining. However, from data at hand it is not difficult to arrive at figures which are reasonably accurate.

For example, an ore bed of 24 in. under a 20-ft. overburden, half of which is hard rock and the other half soil and boulders, will be considered. In this kind of material, where the rock must be blasted, the average steam shovel of 2½-yd. dipper capacity will remove from 1800 to 2500 cu.yd. (equivalent to from 1200 to 1700 cu.yd. in place) in a 40-ft. cut per day of 10 hours. This ore weighs about 225 lb. per cu.ft.

The accompanying table shows the approximate cost per ton of mining corresponding with the removal of varying amounts of loose overburden, and the tonnage of ore which would be developed. The ore developed may be accepted as the average daily output.

PRODUCTION AND COSTS.

Loose Overburden, Cu.yd.	Ore Developed, Tons.	Cost of Mining per Ton.
1500	34	$2.20
1800	40	1.85
2000	44	1.70
2200	50	1.50
2500	57	1.30

FIG. 5. CHURN DRILLS USED IN DRILLING THROUGH OVERBURDEN

The Necessity of Care in Laying a Compressed Air Pipe Line

By Edward K. Judd*

An example of those unfortunate accidents that will happen in the best regulated mines recently came under my notice.

At a certain group of bituminous mines a very complete and expensive air-compressing plant was erected in a central position, and the compressed air was to be carried to the mine openings through lines of 10-in. wrought-iron pipes. One of these lines, nearly one mile long, was laid for part of its distance in a trench which was dug along the side of the railroad yard. This yard had previously been graded and ballasted with washery waste, consisting principally of slate, but carrying a large percentage of sulphur.

When the compressors were started, about six months later, it was found, on investigation, that the portion of the pipe line through the yards had in the meantime been so completely corroded, in spots, as to be totally useless. The destruction of the pipes is obviously explained by the oxidation of the iron sulphide in the washery waste, with its accompanying liberation of sulphuric acid. Corrosion occurred in spite of the fact that the pipe was carefully bedded in clay.

In replacing this pipe line, the company has wisely laid the pipe, carefully painted with asphalt over the surface, supporting it at intervals on wooden blocks and stones. As a one-mile length of wrought-iron pipe represents an outlay of about $5000, the saving to be effected in this way is quite apparent.

The maximum temperature allowed by law in underground stopes in Victoria, Australia, is 83 deg. F.

*Instructor in mining, Columbia University, New York City.

Handling Crushed Rock on San Francisco Bay

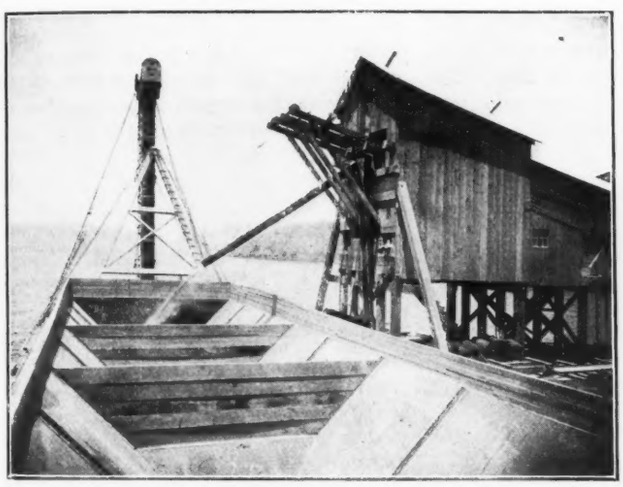
Belt Conveyers and Bucket Elevators Convey the Material to and from the Bins and Load and Discharge the Hopper Barge

BY F. K. BLUE*

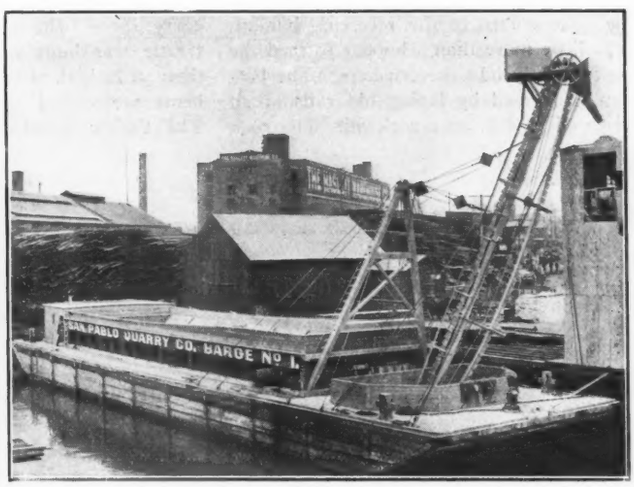
The rebuilding of San Francisco, especially with the greatly increased use of reinforced concrete in construction, suddenly caused a great demand for crushed rock that could not be met by the crushing plants then in operation. All deposits of suitable rock near the city were at once considered with a view of supplying this demand. There are several quarries of splendid rock within the city, but as the city ordinances forbid blasting in the residence district these could not be worked to any great extent, so the supply now comes from several quarries down the peninsula below San Francisco, and from others on the bay shores from which the rock is towed across to the city in barges.

Of these quarries perhaps the most extensive and the best equipped is that of the San Pablo Quarry Company, which shortly after the fire installed a plant across the bay near Point Richmond about ten miles north of Berkeley.

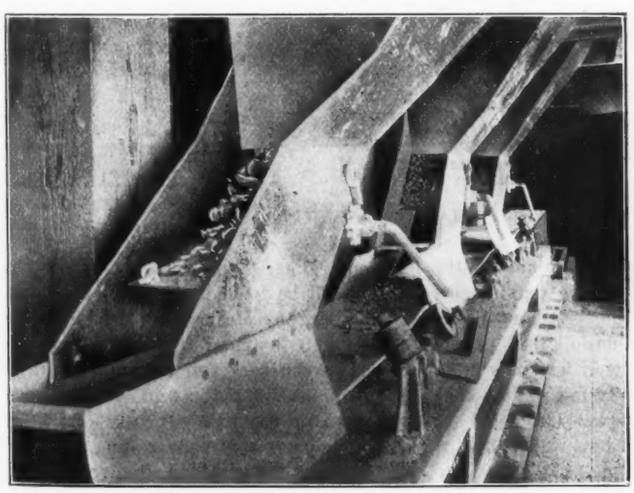
A suitable piece of land on the hills and on the bay shore was secured here for quarry purposes, and operations were begun by stripping the surface of the quarry rock of the overlying coating of soil and clay. This material amounting to about 120,000 cu.yd. was sluiced down from the hillside to an impounding area at the surface of the bay, thus providing about three acres of made ground, at a total cost of about 9c. per cu.yd. The water was pumped from the bay to a hight of 100 to 200 ft. by a three-stage centrifugal pump direct-connected to two 50-h.p. motors, the electric current being supplied by the long-distance transmission lines that run down from a hydroelectric station in the mountains. The water was led up the hill through a 9-in. pipe and thrown against the soil banks through the



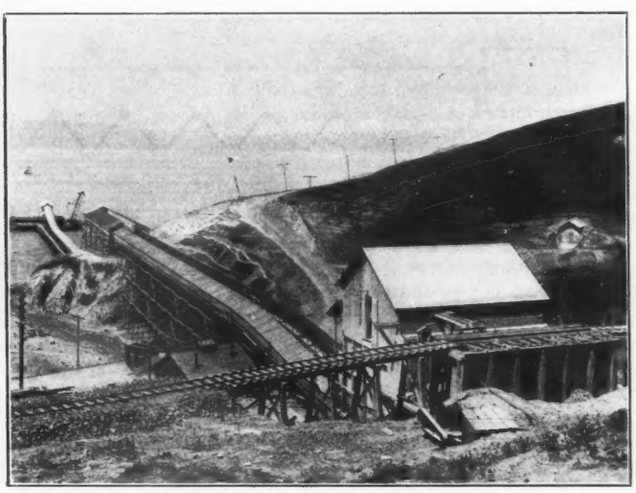
SELF-DISCHARGING BARGE, SHOWING HOPPER BINS



BARGE, SHOWING SWINGING DISCHARGE ELEVATOR



GATES FEEDING ROCK FROM HOPPER TO BELT



CONVEYER SYSTEM TO LOADING WHARF

*Mechanical engineer, San Francisco, Cal.

nozzle of an hydraulic giant, such as is used in placer mining. The material loosened up was carried down a 20-per cent. grade in ditches to the impounding area inside the bulkhead, the quantity of material transported being about 14 per cent. of the quantity of water carrying it. This method of preparing the quarry as well as the convenient method of carrying the rock to the bay and distributing it to San Francisco or any other point on the bay was planned by Edwin T. Blake, the superintendent of the company.

Bins and Transportation

The method used for handling and transporting the rock is shown in the accompanying illustrations. A 9-ton locomotive hauls the rock in 6-ton cars from the quarry face to the receiving bunker. It is little more than a hopper to feed the rock directly into the crushers. The bottom is formed by laying old rails at an angle of 37 deg. on a rock fill. The rock passes through two No. 6 gyratory crushers and is elevated to two 40-inch. x 12-ft. revolving screens in three sections having perforations of ½, 1¼ and 2½ in., with dust rings of ¼-in. holes. The rejections pass through a No. 3 crusher at the lower end of the bunkers and are returned under the bunkers by a belt conveyer and elevated again to the screens. From the screens the rock falls into four compartments containing dust, 1-in. rock, 2-in. rock, and rejections that will not pass a 2-in. ring. In the bottom of each compartment are two feeding hoppers which may be opened to deliver the rock to two belt conveyers which carry it to the four storage bunkers, blasted out of the rock.

The operation of these loading hoppers depends upon the principle that granular material will continue to flow only so long as the surface makes an angle somewhat greater than the "angle of repose" of such material. When the tongue is level the rock can only pile up on it at the angle of repose, but when the tongue is lowered by the lever and held in the required position by the pawl and ratchet wheel the rock will flow gently on the belt as fast as desired, as indicated by the dotted lines in the illustration.

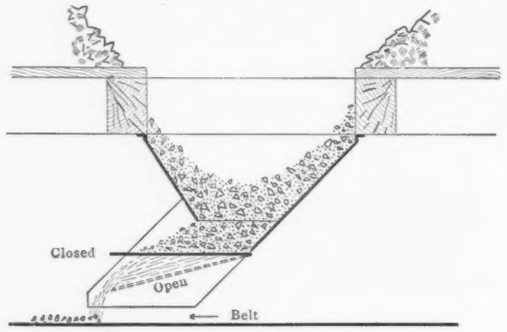
Conveyer System

The two belt conveyers carrying the rock to the storage bunkers are each 16 in. wide and 600 ft. long. They each easily carry 70 cu.yd. of rock per hour at a speed of 320 ft. per minute. The material is lifted about 7 ft. by these belts and they consume 13.5 electrical h.p. each at the motors, which are rated at 15 h.p. To carry these belts over on the bluff a trestle was built which is a little more than 50 ft. high at the highest point. The bents are spaced 16 ft. between centers. The timber is all Oregon pine brought from the mills in boats and laid on the wharf near the work. The 6x6-in. sills are laid on concrete blocks about 12 in. wide and deep. The up-hill post is toenailed to a 3x12-in. plank, which is creosoted and then grouted in flush into a concrete pier set in the bank. The posts are 6x6-in., the outer ones having a batter of 2 in. per foot.

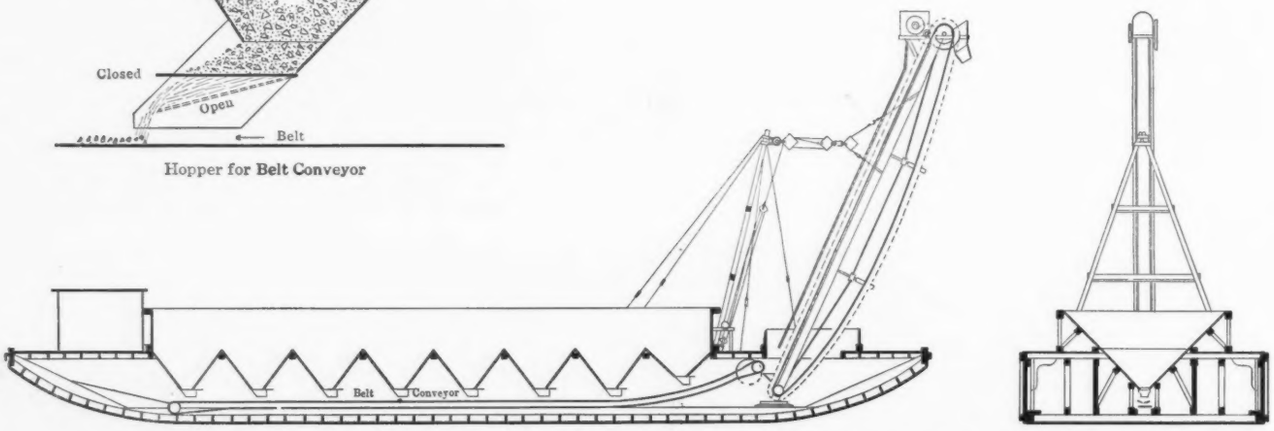
Over the storage bunkers in the bluff there is a self-propelling tripper for each belt which discharges the crushed rock into any of the four bunkers. These bunkers were made by blasting conical holes in the rock and increasing their capacity a little by concrete walls between and around them. They hold from 5000 to 6000 tons each. At the bottom there are loading hoppers similar to those in the upper bunkers, which deliver the rock upon two 20-in. belt conveyers carried in a tunnel in the rock underneath the storage bunkers.

Self-discharging Barge

These conveyers receive the rock from the storage bunkers, carry it out of the tunnel and over the wharf, and deliver it to a self-discharging barge. The conveyers are each 750 ft. long, and the belts are 20 in. wide of five-ply rubber with ⅛-in. rubber carrying surface. They each easily carry 150 cu.yd. of rock per hour at a speed of 450 ft. per min., and they can be loaded to carry 190 cu.yd. per hour without spilling the rock over the sides. At the outer end of the wharf the belts are curved upward to an incline of 18 deg.; by this means the rock is lifted 27 ft. and discharged into the barge by chutes as shown in the illustration. Each conveyer is driven by a 50-h.p. motor. At normal load the electrical h.p. required to drive each conveyer is about 21, but at the moment of starting 74 h.p. is consumed. When both belts are in use the barge will be loaded in about two hours.



Hopper for Belt Conveyor



LONGITUDINAL AND CROSS SECTIONS OF SELF-DISCHARGE BARGE. DETAIL OF HOPPER AND GATE

The barge will carry 600 cu.yd. of rock. It is 120 ft. long, 34 ft. wide and 9½ ft. deep between deck and bottom. It draws 18 in. light and 7 ft., 4 in. when loaded with 700 or 800 tons of rock.

The hopper has eight sliding gates in the bottom, which load the rock on a 20-in. belt conveyer situated under the hopper in the middle of the barge as near the bottom as possible. This conveyer carries the rock to one end of the barge and drops it into a hopper which feeds it directly into the buckets of an elevator. The conveyer is driven by a 5-h.p. motor, and the belt runs 300 ft. per minute.

The elevator is of the close-connected bucket type having a belt speed of 145 ft. per min. and set at an angle of 65 deg. The buckets are 24 in. wide by 12 in. long

on the belt and project 8 in. from it. It is set on a turntable and can swing on an angle of 170 deg., and discharge at either side of the barge, or at the end as desired. The top is held in position by a tackle swung from an A-frame, and it is handled from the deck by tackle and guy ropes fastened near the top.

The frame is made of two channels each 56 ft. long, braced with 2½x2x5/16-in. angles, latticed and with spreaders of plates and angles. It is also stiffened somewhat by the 1¼-in. truss rods, which are connected with the frames carrying the guide rollers. This construction, though probably heavier than if the frame had been made of angles and lattice bars in place of the channels, has proved very serviceable in resisting the knocks it has had in some pretty rough handling during storms on the bay.

The belt is held in position and kept from swinging on its return to the bottom tail pulley by guide rollers of 2½-in. pipe. These are 2½ ft. long to allow for the change in its hanging position as it stretches during service. There are also leading guide rollers to direct the belt upon its head and tail pulleys.

Method of Drive

The elevator is driven by a 20-h.p. direct-current motor which rests on a platform attached to the upper end of the elevator frame, and transmits its power to the head pulley through two sets of spur gears. It is reached by an iron ladder which passes up from near the deck of the barge just over the elevator buckets. The motor is protected by a wooden box built over it and covered with tar paper.

The illustration shows the barge alongside a wharf in San Francisco discharging the rock into a hopper from which it is distributed by a belt conveyer to receiving bunkers. From these it is discharged directly into wagons which carry it to the work in the city.

The current for the motors which drive the conveyer and elevator is furnished by a 25-kw. generator driven by a 40-h.p. gas engine placed under the deck in one of the side compartments of the barge. They are also frequently driven by current supplied from the dock at places where electric power is available.

The belt-conveying machinery for this plant was furnished by the Stephens-Adamson Manufacturing Company, and the crushing machinery and motors were made by the Allis-Chalmers Company.

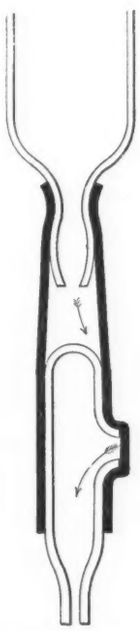
The turbo blowers used to drive the lead-blast furnaces at the Port Pirie works of the Broken Hill Proprietary Company are giving very satisfactory results, but it has been necessary to rebuild the furnaces in order to raise the water jackets, rendered necessary through the more intensive blast from the turbo blower.

Improved Pinchcock for Burettes

By George A. James*

The burette pinchcock, shown in the accompanying sketch, is one that I have used a great many years, and which I consider much superior to anything of its kind, when rubber has no effect on the solution. Based on a principle similar to that involving the use of a bead or shot, it has this advantage, that it does not leak, and it can be used a long time without developing this fault.

To use the cock, the rubber is pressed with the finger and thumb away from the side of the cock, so that the liquid finds a channel through the open teat and out through the open end. The teat or nipple



PINCHCOCK FOR BURETTES

can be so formed that the rubber can be stretched to any degree of tightness, but I find it more handy to use light-walled rubber tubing and a very low nipple.

I find that this is also an improvement on the Bunsen valve, when loose and light rubber tubing is used, and the gases are allowed to escape in the same manner as the liquid. The pinchcock can be made so as to allow the escape of gases under very slight pressure, at the same time preventing any return of gas through the same channel, a thing not easily accomplished with the Bunsen valve.

The production of phosphate rock in the United Kingdom has decreased from a maximum of 258,150 tons in 1876 to 32 tons in 1907. In 1905 and 1906 no production was made. Imports in 1907 were 505,671 tons.

*Assayer and chemist, San Francisco, Cal.

Permanganate Method for Determining Copper

By Fred G. Hawley*

The permanganate method for the determination of copper has been in daily use in the assay offices of the Cananea Consolidated Copper Company for the last three years and has proved satisfactory. Where quick results are required and many determinations are to be made it can be used advantageously; but where speed is not essential, or copper is determined only occasionally, this method has few advantages over other standard methods. For accuracy it ranks with the iodide method and has been checked here daily by the electrolytic method; usually within 0.04 per cent. on careful work.

There are quite a number of reagents used but as each operation is very simple and quickly performed; one determination takes about 30 min., and 20 assays can be made in less than 1½ hours.

The method is essentially the same now as when first introduced here by H. A. Guess, formerly in charge of the chemical department, but it has been shortened and changed in some details. It has been thoroughly tested and the conditions under which the best results are obtained have been carefully determined. No metal commonly found in ores will interfere with the accuracy of the results.

Details of the Method

Weigh 0.5 gram of ore, or more if very low in copper, into a tall 250-c.c. beaker and add 10 to 12 c.c. of a mixture of sulphuric and nitric acids (1:3); if the ore contains talc, clay or similar minerals making filtering slow, add 4 to 8 drops of hydrofluoric acid, place on a hot plate and boil rapidly to dense fumes of sulphuric anhydride. Remove from the hot plate and cool slightly. Add 35 c.c. of water and neutralize with ammonia, avoiding excess. Add 4 c.c. of hydrochloric acid; follow this with 10 c.c. of a solution of sodium sulphite (200 c.c. per liter) to reduce the copper and iron salts. Cover with a watch glass and set on the hot plate until the solution begins to boil, when 5 c.c. of a solution of potassium thiocyanate (40 grams per liter) are added to precipitate the copper. Boil for one or two minutes but not long anough to expel all sulphurous acid. Remove from the hot plate and, with the beaker still covered, allow to settle for about five minutes. Filter and wash thoroughly with a minimum amount of hot, but not boiling water. Replace the original beakers under the funnels and wash the copper thiocyanate with a boiling hot, 6-per cent. solution of sodium hydroxide, which decomposes the cuprous thiocyanate. The sodium hydroxide is best added from a wash bottle

*Mine chemist, Cananea Consolidated Copper Company, Cananea, Mexico.

and the jet directed on the precipitate in such a manner that it is thoroughly stirred, insuring complete decomposition. The cuprous thiocyanate and sodium hydroxide react according to the following equation:

$$CuCNS + NaOH = CuOH + NaCNS.$$

The soluble sodium thiocyanate goes in the filtrate, while cuprous hydroxide being insoluble remains on the filter. After washing thoroughly, acidulate the filtrate with sulphuric acid and titrate the liberated thiocyanic acid with permanganate.

Corrections Necessary

Unfortunately copper thiocyanate is not absolutely insoluble and allowance must be made accordingly. Under the conditions given above a nearly constant amount of 0.005 gram copper, equivalent to 0.1 per cent. on 0.5-gram assay, remains in solution, lowering the reading by that amount. A partial compensation for this error is made by the small amounts of oxidizable matter in the sodium hydroxide and from the filter paper which raises the result 0.05 c.c. In summing up these two errors, the reading will be only 0.05 per cent. too low on 0.5-gram assay.

The strength of the permanganate solution is such that 1 c.c. is equivalent to 0.01 gram of iron. If the iron value of the solution be multiplied by 0.197 and 0.0025 gram added (for the copper left in solution) the result is equal to the copper content. Thus on 0.5-gram assays, 1 c.c. of permanganate is equivalent to nearly 0.04 per cent. copper, or 0.02 per cent. on 1-gram assays. A table may easily be made to convert the readings for iron to percentages of copper.

Where extreme accuracy is not required the permanganate solution may be so made that each 1 c.c. equals 1 per cent. copper on 0.5 gram; then in standardizing and in regular work add one drop, or about 0.05 c.c. excess to allow for the copper left in solution. This solution requires about 14.5 grams potassium permanganate per liter. Much time is saved by making all solutions of definite strength and keeping them in bulk. These solutions are added to the assays from large 500 c.c. dispensing burettes. With a little practice one can judge the amount used so closely that the reading need not be taken.

Precautions

If the amount of hydrofluoric acid used does not exceed a few drops it will not sensibly affect the beaker or larger particles of ore, but will effectually decompose the slimes. I have used it 25 times or more in the same beaker before the glass showed signs of etching. This treatment with hydrofluoric acid lessens the tendency to spit and bump, while boiling off the nitric acid, and leaves the assay in a condition to filter rapidly later on. Under proper conditions, hydrofluoric acid can also be used to advantage in other determinations that are to be made on ores difficult to filter; it is useful in the iodide method for copper and the molybdate method for lead.

If the solution turns red (and stays so) after adding the thiocyanate, it indicates that some iron is in the ferric state, and that more sodium sulphite should be added to reduce it. Ferric salts react with cuprous thiocyanate, oxidizing it and the results are then slightly low.

Five cubic centimeters of potassium thiocyanate solution will precipitate 0.125 gram of copper; therefore, if the ore contains more than that amount more thiocyanate should be used, but a large excess is to be avoided.

Hydrochloric acid may be present up to 4 per cent., but above that amount it noticeably increases the solubility of the cuprous thiocyanate. Free sulphuric acid should not be present except in very small amounts.

When titrating, the solution should have a bulk of at least 100 c.c.; otherwise some of the hydrocyanic acid formed in oxidizing the thiocyanic acid may escape into the room with injurious effect.

When extreme accuracy is desired it is best to measure the reagents as the results are somewhat affected by any considerable variation in the quantity used. In the permanganate method, as in most others, some experience and careful attention to every detail is necessary to secure the best results.

Mine Taxes in California

Special Correspondence

One large mining company in any mining district makes quite a material difference to the locality, and is generally worth a dozen or so small ones. A good instance of this is that of the North Star Mines Company, of Grass Valley, the most productive gold mine in California. This company pays about $16,000 a year taxes to the county of Nevada and in the matter of a special school tax recently paid $1400 of the school district taxes, amounting in all to $6000. The company bears a goodly proportion of the burden of taxation in the district and the county. This is one of the few gold mines of California which annually publishes a complete report of its affairs including its earnings and expenses so the tax collectors are in no doubt as to what to do. Most other companies which are mining in California conceal the figures of output so the tax collector cannot assess them too high. This is one reason why statisticians have trouble in obtaining figures of output, the mineowners supposing that perhaps the figures may be learned by the tax collectors, which is a foolish idea, for such returns are always held confidential, and, in fact, tax collectors never even ask for them, knowing they would be refused the information.

Steel Construction

In all steel-work construction it is the usual and best practice to bring all strain lines to a meeting place in a common point. This, however, is sometimes difficult, and gusset plates of sufficient stiffness to take up the torsion are introduced. This is one reason, but far from the only one, for the economy shown in certain classes of truss work, where the members are built up of two angles and a continuous plate rather than of the usual two angles with gusset plates introduced at the panel points only. The economy of this type of truss is not only in the saving effected in the shop by the handling of a smaller number of pieces, but the purlins resting on the top chords do not have to be brought over panel points. The moment of inertia of the combined section is sufficient in properly proportioned trusses to take care of the bending moment introduced by purlins resting between panel points. The amount of templet making is also reduced, especially of the smaller sizes, and the greater portion of the riveting being done by a multiple punch, otherwise known as a "cosine" punch the work of fabrication is facilitated to no slight extent. Trusses of this type, having more material in them than the ordinary angle and gusset-plate type, are really cheaper to build than the latter, in most cases.

An excellent arrangement when trusses are brought down on the top of columns in buildings of gable construction is to make the columns of channel sections, with the flanges turned in, and latticed; the cap plate of the column is made the base plate of the truss, and the struts between columns on the side of the building are made of four angles back to back in the "I" section, latticed. Where the struts connect, they straddle the cap plate of the column and the base plate of the truss, whichever the single piece may be termed. The bottom chord bracing is riveted to the same plate, and all strain lines are thus brought together at one common center; in this case, the center line of the column at the cap plate. The top chord bracing in the roof trusses is usually made of sway rods, and for work of the character found about metallurgical plants, they give ample sectional area. Elongated holes are punched through the top chord web plate, and a check washer made up of a bent plate is riveted over this; the sway rod is placed through a hole in the end and drawn up by nuts. No clevises are required, and the threads at both ends of the sway rod can be right-hand.

Irrespective of the load which any column has to carry, if made of channels it should not be constructed of less than the 6-in. size; even this is usually too light for rigidity, and 8-in. channel columns are used in the best practice for the lightest loads.

A Scientific Search for a New Goldfield

By a Study of Ore Occurrence at Goldfield and of the Fault Systems of Nevada a New Alunite and Gold District Was Discovered

BY ROBERT T. HILL*

The discovery of the close association of alunite with the gold ores at Goldfield, which had not been recognized in Nevada prior to Ransome's investigation, throws great light upon the origin and nature of the ores, and in seeking other gold localities in that State the occurrence of alunite in association with gold would be a prime desideratum. This belief that we might find another alunite gold locality was inspired by the following extract from Ransome:[1]

"It is not believed that the Goldfield district is unique in the possession of this alunite type. Other examples are likely to be found among the great number of ore deposits associated with Tertiary volcanism, particularly when more investigators of mining districts realize the importance of close studies of rock alteration, such as have been so admirably carried out in this country by Mr. Lindgren and in Europe by the later Professor Stelzner, and when they accept neither kaolinite nor sericite on faith and external appearance."

Having endeavored to assimilate the type of ore occurrence and outcrops at Goldfield and to familiarize myself with the aspects, I resolved to take to the prospecting field and endeavor to find another locality in Nevada similar in its general features to Goldfield.

Difficulty of Distinguishing Alunite

Clearly the task before us was to find another area of igneous rocks approximating those of Goldfield, which had been similarly alunitized by fumarolic action and which carried at the surface prospect similar gold and associated minerals. Now alunite is a rare and not easily distinguishable mineral, and I am frank to say that, after a summer's research for it and the successful finding of it, I would pronounce no rock alunite, except by aid of both careful microscopic examination and chemical analysis.

In fact an eminent authority upon petrography, who has aided us in our researches, has stated that alunite is such a new thing in rock analysis that it emphasizes the necessity of confirming the results of microscopic determination by chemical tests, particularly where the quartz or alunite occurs in crypto-crystalline condition.

In the face of such conditions the finding of alunite would appear apparently a hopeless task; but such is not the case, for the broader principles of geology came to our assistance, and by their aid we were enabled by successive steps from condition to condition to find another locality of the alunite type.

The processes of reasoning which were pursued were as follows: Inasmuch as alunite is an alteration product of the feldspar of certain volcanic rocks, which had been penetrated by fumarolic vapors arising along fractures, and inasmuch as such occurrences of volcanic rocks and fractures usually occur at areas of fault intersections, the problem before us was first to find an area exhibiting the general controling conditions, i.e., altered igneous rocks, evidence of fumarolic action, and good faulting, and then, by the aid of the microscope, chemical analysis and the assay, to determine whether they were alunitized and mineralized.

BLACK ANDESITE PORPHYRY ALTERED ALONG A FAULT LINE

Prospecting Outfit

My principal equipment consisted of an observing eye, a belief that in nature there is a law for all things, a knowledge of what others had found out about these laws and country before me; and whatever kind of transportation the people of the country used. A gold pan, United States Geological Survey topographic maps, for such areas as are covered by them, and a traverse plane table were also carried.

Of course, one could have added all kinds of things to these essentials sufficient for a completely equipped caravan: Blowpipe outfit, petrographic microscope, field tents, leggings, Piccadilly collars, and everything one could think he might need. It has been my experience, however, that the best way to outfit is to assemble carefully everything one thinks he could need and then to hold an inquest over the pile and throw away everything one can possibly do without. As a result, a good prospecting outfit will reduce itself (aside from transportation) to a cow-boy blanket roll, a coffee pot, a frying pan, a bread pan, a stew pan, one extra canvas for rain or shade, a saddle, something to eat, and a compass.

The Rocks of Nevada

Another important point in the geology of Goldfield not touched upon in the foregoing descriptions, is that the Goldfield volcanic area is situated in a greatly faulted area and probably at a point along that fault where there have been great intersections. This fact of broad geology brings the prospector to face some general conditions which must be touched upon.

The broader physiography and geology of Nevada is the simplest thing in nature and the most poorly represented on maps of any part of our country. In general it consists of elongated mountain ranges and stretches of desert. The topography can all be classified into destructional mountain forms and débris-filled valleys. Very rarely there is an originally piled-up mountain in the form of an isolated basal-

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[1]"The Association of Alunite with Gold in the Goldfield District, Nevada." By F. L. Ransome. Economic Geology. Vol. II, No. 7, pp. 667-692; Oct.-Nov., 1907.

[2]Excellent description of the rich and general geology of southwsetern Nevada will be found in Bulletin 308 of the U. S. Geological Survey, entitled "A Geological Reconnoussance in Southwestern Nevada and Eastern California." By Sydney H. Ball.

tic cone. The formations and material can all be grouped into these three simple categories: The bed-rock complex, later igneous rocks and desert material. The mountains are composed of bed-rock complex and Tertiary eruptives; the desert formations are made of their débris.

The bed-rock complex is composed of three distinct unit groups of rocks: (1) Pre-Cambrian metamorphics and granites; (2) ancient marine sedimentary rocks of Paleozoic age, quartzites, limestones, shales, etc.; and (3) with some few patches of Mesozoic.

This group constitutes most of the mountain masses and, as a whole, it is wrinkled or folded in open anticlines and synclines, and most of these wrinkles were made before the modern eruptives and faulting appeared. As a whole, so far as gold occurrence is concerned, this group may be considered as a unit.

The Tertiary igneous rocks include granite (monzonites) "porphyries" (andesites) rhyolite, latite, "malpais" (basaltic lavas), and many other species of intrusives and effusives (igneous rock) of later geologic time, protruding into and through the basement complex.

It is a hopeless task for the prospector ever to learn to distinguish the various species of igneous rock; "granite," "porphyry" and "malpais" as used by him are pretty good field classifications, and about as far as he can go without plunging into error. The best way for him is to learn to tell them as a class and to cut out the other mountain rocks, belonging to the complex basement, from his field of research.

Fault Systems

Of all natural aspects, faults and fault systems are the most important and essential guides and features in mining and prospecting provided mineralization has been determined. Faults are the great channels through which the volcanic magmas and their mineralizing vapors reach the outer crust, and are the accompaniments of the same earth movements which produce folded mountain systems. There are fault systems as well as mountain systems. Sometimes even these fault systems antedate the folding.

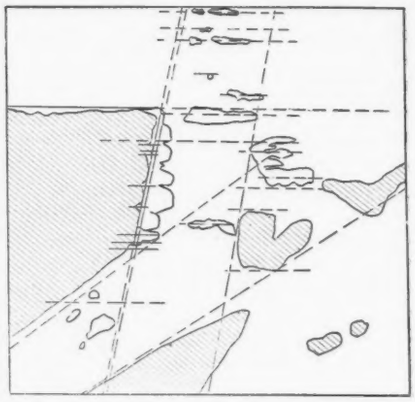
The effects of faulting persist in nature longer than the effects of folding, and these effects dominate the topography and geography of the country more permanently, although in a less readily discernible manner than any other structural feature. The mountains will wear away, but the fault fractures preserved in the eroding by the cliff line or adopted by the water courses will persistently impart their presence on all future geography, as the directions of the courses of great rivers or even the desert valleys.

Desert weathering and degradation of the type which I recently described in another article, has dulled the regularity of the fault scarps in some instances, but to one versed in physiography many examples are preserved in southern Nevada where they are astonishingly and overwhelmingly apparent. However faults may be found in social affairs, it is difficult for men to find them in nature. In fact, the talent of geological faultfinding or seeing is often lacking even in professional geologists; and their appreciation comes from long topographic and geologic experience. A knowledge of fault finding is one of the most important equipments to the prospector, for all great ore deposits not only occur in or adjacent to great fault systems, but frequently and usually at their intersection.

Now to the miner it is more important that the fault systems should be unraveled than the folding, for sometimes, as in Nevada, especially at Goldfield, the mines are found in eroded valleys where the faults persist and the mountains do not; and again much of the mountain folding is more ancient than important fault systems.

Three great tectonic movements, each accompanied by intense faulting in a characteristic axial direction have left their impression on the topography of Nevada, and have made the channels for the ascending vapors of mineralization. Two of these types, the northwest-southeast and the north-south, are now well known to dominate the American Cordilleran continent. The third, the east-west, which has not as yet been interpreted or described, is also most important and its full significance will become clearer as research progresses. The three major fault systems mentioned are: (1) the Rocky mountain north-south system, (2) the Mexican or northwest system, and (3) the little understood east-west system.

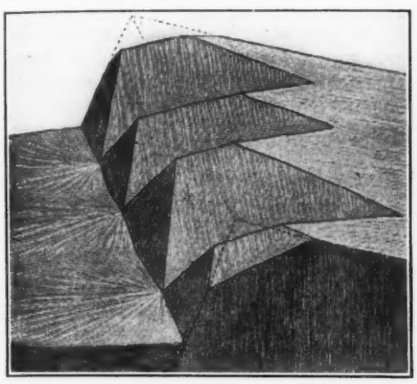
THIRTY-SIX HUNDRED SQUARE MILES OF NEVADA SHOWING REGIONAL FAULTING



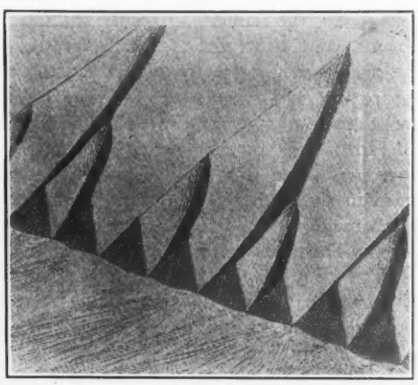
ONE SQUARE MILE OF THE REGION SHOWN IN THE LARGER MAP

The Mexican, or northwest system, cuts obliquely across the north-south and east-west systems, producing along the western border of Nevada nearly parallel to the California-Nevada State line, a series of northwest-southeast ranges and valley deserts of the Death Valley type.

The greater mineral occurrences of southwestern Nevada, as well as of Arizona and the Mexican plateau, practically occur at intersections along this northwest-southeast fracture system. In fact, if one will place a straight edge upon a proper map of North America and draw a line from Comstock, Nev., to Pachuca, Mexico, a distance of 2500 miles, he will find that many of the great modern mining camps



NO. 1



NO. 2

of the Cordilleran region lie adjacent to this line, including Comstock, Tonopah, Goldfield, Searchlight, Globe, Clifton, Bisbee, Cananea, Ocampo, Guanajuato, El Oro and Pachuca.

Relation of Faults to Ore Deposits

The occurrence of the great mineral localities discovered along this zone is a broad generalization which needs refinement, for it is not alleged that the zone is continuously mineralized. It is known that the ore occurs only widely in spots along this zone in southwestern Nevada and elsewhere.

It is this crossing of the north-south Rocky mountain fault trend by the northwest Mexican fault trend that causes some of the greatest and least explained topographic phenomena of the Mexican region, like the sudden transitions in Arizona and New Mexico from the Colorado plateau and Rocky mountain region to the physical characters of the Mexican plateau; in the great bends of the Colorado, the southern scarp line of the Colorado plateau and the remarkable geological crux at El Paso, Texas, and other points which I have lately described.[2]

The effect of these three great interesting fault systems upon the hard consolidated strata of the folded basement complex in Nevada is a series of elongated mountain blocks (ranges) separated by intervening valleys and deserts, which were developed originally by drainage along fault lines. In a general way the great fault lines are indicated in the topography on good maps, like the Amargosa and Las Vegas quadrangles of the United States Geological Survey, but are utterly lost on bad maps, like the average commercial map of Nevada. There is no good map of the State. Concerning the "Geological Reconnaissance Map of Nevada, South of the 10th Parallel," by J. H. Spurr, the author, in accordance with a good principle that a bad map is better than no map, frankly confesses that: "Anyone examining it closely will find it nearly all inaccurate."

Unfortunately for the miner, as well as for knowledge in general, the occurrence, sequence and relations of the great fault systems of Nevada have not been clearly mapped and defined. Most of the geologic literature of Nevada, with one or two notable exceptions, seems to be controversal in regard to the fault systems, and the controversy seems to have ended without conclusions. G. K. Gilbert, the dean and master of American physiography, 30 years ago announced his theory that the desert ranges of Nevada were chiefly faulted blocks. Spurr, the young and intrepid, later controverted this theory and concluded that the mountains were mostly residual erosion forms. I am not the umpire in this controversy; but my opinion, based upon my own observations, is that Gilbert's position is in general more nearly correct, and that Nevada is check-boarded with great faults which, when understood, will be found to be the chief key to most of its geographic, geologic and mineralogic features.

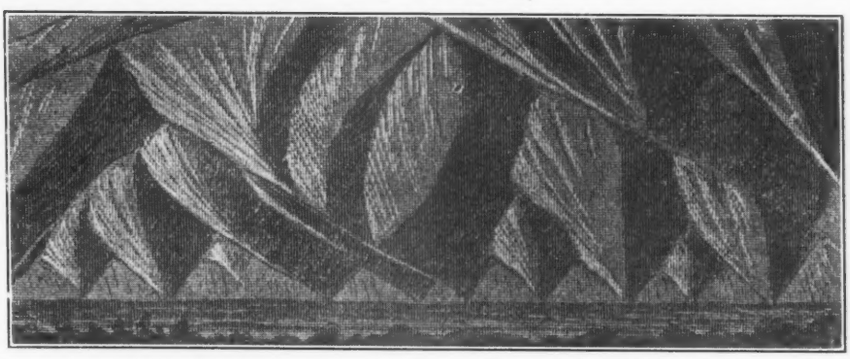
Spurr has said that: "The chief faults belong to a north and south and an east and west system."[3] I believe that if he would continue his work farther that he would now say that: "The chief faults of all the faults run in a west of north to south of east direction, and that the north and south and east and west systems are subordinate to them."

Tonopah, Goldfield and Rhyolite are all along a great northwest-southeast fault. At Rhyolite this intersects with a still more northwesterly fault extending toward Searchlight and bleaching out the west side of Spring mountain range, and these faults cut through Railroad pass. Where the east-west faults and north-south faults intersect with the northwest faults, hot springs still frequently exist, and ancient alunitizing fumarolic localities should be looked for. The east side of Spring mountain range and the west side of El Dorado ranges are also bounded by faults parallel to the Rhyolite-Searchlight fault.

Applying the Principles Discovered

It is not necessary to weary the reader with the details of how we proceeded to apply these principles in prospecting trips in Nevada. It is sufficient to say that after many miles of desert travel and pleasant camp experiences, we canceled out as impractical large areas and explored others which seemed probable. The result of our investigations, however, was finally successful, and an area was found combining all the essentials, features of rock material, faulting, rock alteration, alunitization, surface mineralization and other peculiarities of Goldfield.

The finding of our locality, however, was a simple task in comparison with the continuation of our prospecting the claims to be staked, the monuments to be recorded and the location work to be done. A good topographic map also had to be made. Fault lines and their intersections had to be unraveled and careful microscopic and chemical studies made of the



NO. 3

THREE MODELS BY PROF. W. M. DAVIS, OF HARVARD, SHOWING PROGRESSIVE FAULTING AND EROSION, THE LAST DRAWN FROM SPANISH WAHSATCH RANGE

[2]Science, May 3, 1907, pp. 710-712.

[3]"Origin and Structure of the Basin Ranges," p. 241.

rock material. Finally, sites had to be selected for prospect shafts. Today workmen are steadily sinking toward the expected ores of the unweathered zone. The details of this locality which may be called a scientific prospect will be described in a later article.

Gold Dredging in California

SPECIAL CORRESPONDENCE

The dredging industry of California is fast increasing in importance and in output. The new machines recently built are far more powerful and of greater capacity than those first in use, and what is of still greater importance are more cheaply operated and better gold savers. The use of double banks of gold-saving tables on the larger machines gives much more amalgamating surface that was possible by the old plan. The adoption of hydraulic nozzles throwing water under pressure on the hard ground in certain localities, breaking it down into the buckets, relieves the dredges of much work, and increases their capacity for digging in a given time. The rotary screens are also excellent, especially where the gravel is hard to wash. It was this feature which brought about the litigation recently alluded to in THE ENGINEERING AND MINING JOURNAL, and the courts have decided that the combination involving the rotary screen or grizzly as one of its elements can be used only by permission of the inventor.

Twelve new dredges have been set in operation in this State since the beginning of the year and about a dozen more are being built or are planned for. There are now 69 gold-mining dredges in operation in California. Of these 37 are in Butte county; two in Calaveras county; one each in the counties of Merced, Stanislaus, Shasta, Placer and Siskiyou; 10 in Sacramento, and 15 in Yuba county. The principal fields continue to be at Oroville, Butte county, Marysville, Yuba county and Folsom, Sacramento county, where there are large tracts of available dredging ground at points where the Feather, Yuba and American rivers cease to be torrential streams and widen out as they debouch from the mountains or foothills into the valley sections. It is at points like these, in cases where the streams flow through placer fields, that the best dredging ground is found.

At such points, though the gold is fine, it is pretty evenly distributed through the gravel and the average per cubic yard is subject to little change. At other places in the State small areas of ground available for dredging have been found in isolated spots, generally but a few hundred acres in extent. At such places one or two dredges can be profitably installed. Along the Klamath river in Trinity and Siskiyou counties several dredges are being built, but not more than one at any particular place, the area where dredging may be carried on being usually small.

The most profitable dredging appears to be carried on near to, but away from the rivers themselves and but little is being done in the river beds proper. Those set at work directly in the river beds in most of the counties of the State are liable to be enjoined unless they are "landlocked," that is, throw a rock wall around the pits where operations are carried on, so that the material disturbed in the digging may be confined and not allowed to pass into the running stream. Where this latter occurs, there is liability of damage to the lands adjacent to the streams, and litigation is apt to ensue. The dredge-men perfectly understand this feature and are usually careful to avoid any chance of harming other interests and involving themselves in lawsuits. Moreover, when dredges are operated in the main rivers there is liability of wreck and damage to the machines in case of floods. This was demonstrated at Oroville last year, for the spring floods in the Feather river destroyed several dredges altogether, and damaged several others so that costly repairs had to be made. Operations are now almost entirely confined to places at some distance from the river bed, though some machines are running close to the banks so as to mine certain tracts of land there. Some of the large new dredges are now mining in soft ground at a cost of less than 2c. per cubic yard for operating expenses.

This month the dredge which has been building at Hamburg Bar, on the Klamath river, Siskiyou county, has been launched. The machinery was built by the Byron Jackson Iron Works in San Francisco, and is of the suction type. The principal owners in the company are J. A. Brent and Thomas Bair, of Arcata, Humboldt county.

At Marigold, in Yuba county, a pit is being dug for launching the hull and installing the machinery of the largest dredge in the Marysville field. The big Scott river dredge in Siskiyou county has been started up. The building of this dredge was a difficult undertaking as the heavy machinery had to be hauled over mountain roads a long distance from the railroad station, and even the heavy timbers had also to be transported by team. The Gold Bar Dredging Company, of Chico, Butte county, is building a "dry land" dredge to be used in that county.

The Mokelumne Dredging Company, in Calaveras county, has reconstructed its dredge this year and installed electric machinery. This is a Philadelphia company. The shortness of water this fall has affected the dredging industry in California to some extent, mainly in the way of reduced power available. The search for available dredging ground is still continued, and much prospecting and drilling is going on in different portions of the State.

Gold Production in Australasia

During the third quarter of the present year gold production in Australia and New Zealand has improved. The returns for the first half of the year showed a decrease of 2.6 per cent. in the total output, as compared with 1907; but for nine months, now covered by official returns, the loss is only 1.9 per cent. The table herewith sums up the official returns for the nine months ended Sept. 30, in nearly complete form. It has been necessary only to estimate the comparatively small production of South Australia and Tasmania. The South Australian figures include the Northern Territory:

GOLD PRODUCTION OF AUSTRALASIA, NINE MONTHS.

	1907.	1908.
Western Australia	1,247,153	1,235,367
Victoria	502,084	483,426
Queensland	341,873	338,053
New South Wales	182,473	170,296
South Australia	11,250	10,025
Tasmania	48,100	39,900
Total Commonwealth	2,332,933	2,277,067
New Zealand	359,600	363,533
Total, oz.	2,692,533	2,640,600
Total value	$55,675,327	$54,581,202

The total decrease shown this year was 51,933 oz., or 1.9 per cent. Only New Zealand shows a gain.

Western Australia showed an increase of 9450 oz. during the third quarter; this, however, was not enough to offset the loss during the first half of the year. The decrease would have been less, but for a stoppage in the Kalgoorlie mines in July, resulting from short supply of fuel, owing to a strike. The main cause of lower production, however, is the lower grade of ore in some of the chief mines. This State supplied this year 46.8 per cent. of the total Australasian production.

In Victoria, the second State in production, the decrease was due chiefly to the closing down of several of the deep lead mines, and to a reduction in the output of the Ballarat district. The old district of Bendigo maintains its position as a large producer. In Queensland the decline was almost entirely in the gold obtained from the copper smelters. Mount Morgan kept up its record, but several other districts decreased.

New South Wales had the largest proportional decrease, resulting from the temporary closing down of several large mines. Like Western Australia, however, this State increased its production in the third quarter. Tasmania and South Australia are comparatively small producers; the latter is quite likely to show an increase in the fourth quarter from the inclusion of belated returns from the Northern Territory.

In New Zealand the increased production was from the Waihi and the lesser

mines in the Ohinemuri district; with some assistance from the mines in the new Tairua district. The dredging returns from the West Coast and Otago districts are declining. The Waihi continues to make good its position as one of the great gold mines of the world.

Indications are that the gold production of Australasia for 1908 will be larger than appeared probable earlier in the year; it may equal that of 1907, and if not, the decrease will be small.

California Quicksilver Mines

SPECIAL CORRESPONDENCE

The closing down of the Great Eastern quicksilver mine, in Sonoma county, California, marks the end of a mine which has been productive for the past 20 years. Under present conditions of the quicksilver industry it is no longer profitable. Indeed, few mines in California are making any money out of cinnabar ore. The exception is the New Idria, of San Benito county, where the operations are conducted on a large scale and under economical conditions. B. M. Newcomb, the manager of that as well as other California quicksilver mines owned by Boston capitalists, has bent all his energies toward reducing expenses, both of mining and reducing the ores, and has installed every labor-saving device possible. He spent much money in overhauling the plant and putting it in shape to handle very low-grade ores, and in this has been specially successful. The mine has been for some time the largest producer in California, taking the place of the old New Almaden in this respect.

Water Power Plants for California Mines

SPECIAL CORRESPONDENCE

On Dec. 10 the new plant of the Great Western Power Company, at Las Plumas, on the Feather river, about 20 miles above Oroville, Butte county, will be put in operation. Work has been going on there for several years, and many millions of dollars have been spent in construction and machinery. It is supposed that this is the largest electric generating plant in the world, as it will produce 144,000 h.p. The whole river will be turned through the three-mile tunnel, gaining a fall of 75 ft., and at the lower end of the tunnel there is a drop of 540 ft. to the power house. The entire tunnel is lined with concrete and smoothly finished inside. An old mining tunnel was utilized, extended and widened for this purpose. There are eight generators of 18,000 h.p. each, four of which will be put in operation next month. The new Cowell cement works in Contra Costa county, 150 miles distant, will start at once as soon as this electric power is turned on. The power will not only be furnished to mines, but small towns and to the cities of Oakland and San Francisco. This new plant is nearly five times as large as that of the California Gas and Electric station at Electra, heretofore the largest in the State.

The Northern California Power Company, which already has three large electric plants in operation, has commenced work on a fourth one, on Battle creek, in the Manton district, Tehama county. Owing to the difficulty of hauling in steel pipe, a boiler and machine shop is being built on the site of the power plant where the pipe will be manufactured. The water of several irrigating ditches will be added to the waters of Battle creek to furnish an adequate supply for the new power plant.

Ore Treatment at Mount Morgan, Queensland

There are three classes of ore at Mount Morgan, Queensland, Australia, (Bull. No. 6, *Mineral Resources,* Department of Mines, New South Wales, p. 68): The oxidized, non-cupriferous, free-milling ore found above the 300-ft. level; the slightly cupriferous pyritic ore, treated by roasting and leaching and found between the 300- and the 600-ft. levels; the cupriferous pyrite ore, treated by smelting and found below the 650-ft. level. The gold in the first class of ore is recovered by ordinary milling and chlorination. The slightly cupriferous ore, which contains about 1 per cent. copper, is treated by roasting, leaching with sulphuric acid, and then by chlorination to obtain the gold. The ore is crushed in ball mills to 20 mesh, and then roasted in reverberatories. After that, the roasted ore is charged into vats of large capacity (several holding 1000 tons). This ore is first treated with a weak solution of sulphuric acid (waste liquor from cementation canals) which dissolves most of the copper. The roasted and washed ore is then treated with chlorine solution so as to dissolve the gold. As this solution dissolves more copper, after the gold is removed by precipitation on charcoal filters, the solution is passed through copper-precipitating canals; the solution is then brought up to proper chlorine strength and used again.

The timbers and ironwork, such as ladder hangers, etc., in the Moruya silver mine, Australia, after being under water for 35 years, according to *Bulletin* No. 6, page 58, Department of Mines, New South Wales, were found to be in good condition. The ore is mainly arsenopyrite with some zinc blende. The preservative agent was, therefore, probably arsenic.

Coniagas Mines, Ltd.

The report of the Coniagas Mines, Ltd., for the fiscal year ended Oct. 31, 1908, states that the concentrating mill has been extended and 20 stamps have been installed together with a gas engine and additional concentrating machinery. Ten more stamps are to be added and the capacity of the mill will be increased from 45 to 90 tons per day. A new shaft has been sunk near the mill and all ore is now hoisted from this shaft and dumped directly into the mill.

During the year development was as follows, the total to date being given in parenthesis: Shaft sinking, 272 ft. (422 ft.); drifting, 2096 ft. (3756 ft.); crosscutting, 96 ft. (641 ft.); winzes, 94 ft. (94 ft.); total, 2558 ft. (4913 ft.).

It is estimated that from these openings the following quantities of rock have been excavated: Crosscutting, 2280 tons; drifting, 12,980; stoping, 13,680; open cutting, 4680; shaft sinking, 1400; winzes, 320; total, 35,340 tons. Of this amount 2530 tons were barren, 14,796 tons are mill rock on surface, 3950 tons are mill rock in stopes and 14,064 tons have been put through the mill. The rich ore was hand-picked from about 33,000 tons and the 14,064 tons milled yielded 297 tons of concentrates. The property has produced 3,444,000 oz. silver to date of which 1,444,229 oz. were produced in the year ended Oct. 31, 1908.

A statement of working expenses follows:

Receipts:	
From ore	$709,415
From camp	15,392
Interest and rent	2,388
Total	$727,195
Expenses:	
Mining	$ 84,165
Fuel	26,315
Milling and sorting	30,196
Taxes and royalty	24,459
Sale of ore	11,372
Administration and all other	48,970
Total	$225,477
Profit for year to Oct. 31, 1908	$501,718
Balance from previous year	264,762
Total	$766,480
Dividends paid	440,000
Surplus	$326,480

The works at Thorold, Ont., are producing silver and white arsenic and the company expects soon to refine and market the oxides of cobalt and nickel.

Correction

In the JOURNAL of Nov. 21, 1908, p. 1006, owing to a mistake in the revision of the article, "Las Chispas Mines, Sonora, Mexico," by B. E. Russell, an incorrect illustration was used. The cut indicated as "Las Chispas Mines, Mexico," illustrates the new concentrator of the Montezuma Copper Company, at Nacozari.

Facts Concerning the Marianna Explosion

The Fan Indicator Diagram Shows That Ventilation Stopped 25 Minutes before the Explosion. Mine Inspector Says the Clock Was Slow

BY FLOYD W. PARSONS

The Marianna explosion will soon be recorded as past history and will only be remembered and referred to, by the general mining fraternity, because of the lessons it has taught. At this writing, the final verdict of the coroner's jury has not been rendered, and as a consequence the greater number of material facts are reserved by the mine officials and the State inspectors for the inquest that will be held. It is, therefore, useless to theorize and attempt to draw conclusions until this important evidence has been heard.

The most unfortunate fact concerning these coal-mine explosions is that we heretofore have benefited so little from each succeeding disaster. At this time last year we were in the midst of a series of frightful mine accidents, from which we emerged with a firm determination to search for enlightenment that once secured would place our coal mines in a position of greater safety and reduce mine fatalities to a minimum. Although the past eleven months has been practically free from explosions of gas and dust, the interest aroused last winter has lagged but little and we are justified in feeling that more progress has been made during the year than in any equal period of time that has preceded.

The United States Geological Survey at its testing station in Pittsburg has installed one of the most complete plants ever designed for the scientific investigation of causes leading to accidents in coal mines. We are also profiting at present by the frank statements of experienced mine engineers who have heretofore either neglected or refused to stand committed, and thus lend their aid to a better solution of the problems involved.

The Marianna Mine is Ideal in Its Plan

If I had been handed the mine maps showing the underground development plans of all the mines in western Pennsylvania, I feel safe in saying that a casual examination of the different drawings would have caused me to pick most any other mine as the probable location of the next mine explosion rather than the operation at Marianna. Mr. Jones, the president of the company, is a man who has spent many years in the operation of coal mines, and being somewhat idealistic in his views, had used his past experience as a guide in creating at Marianna an operation embodying the most modern of approved ideas, both on the surface and underground.

The accompanying map shows plainly the plan of operation here intended for the development of the property. Instead of having two main entries, or even four as was recently considered the best practice, the development scheme here called for six main entries. Two of these are used to take empty cars to miners at the face of the workings; two other entries return loaded cars from the face of the workings to the bottom of the shaft; the two remaining entries are used for special air courses to return the impure air and gases to the air shaft, and deliver this dangerous atmosphere to the outside of the mines in such a way that no person at any time might be injured by coming in contact with this exhaust air. All return airways were separated from the gangways where men were working by brick or concrete walls, or pillars of coal.

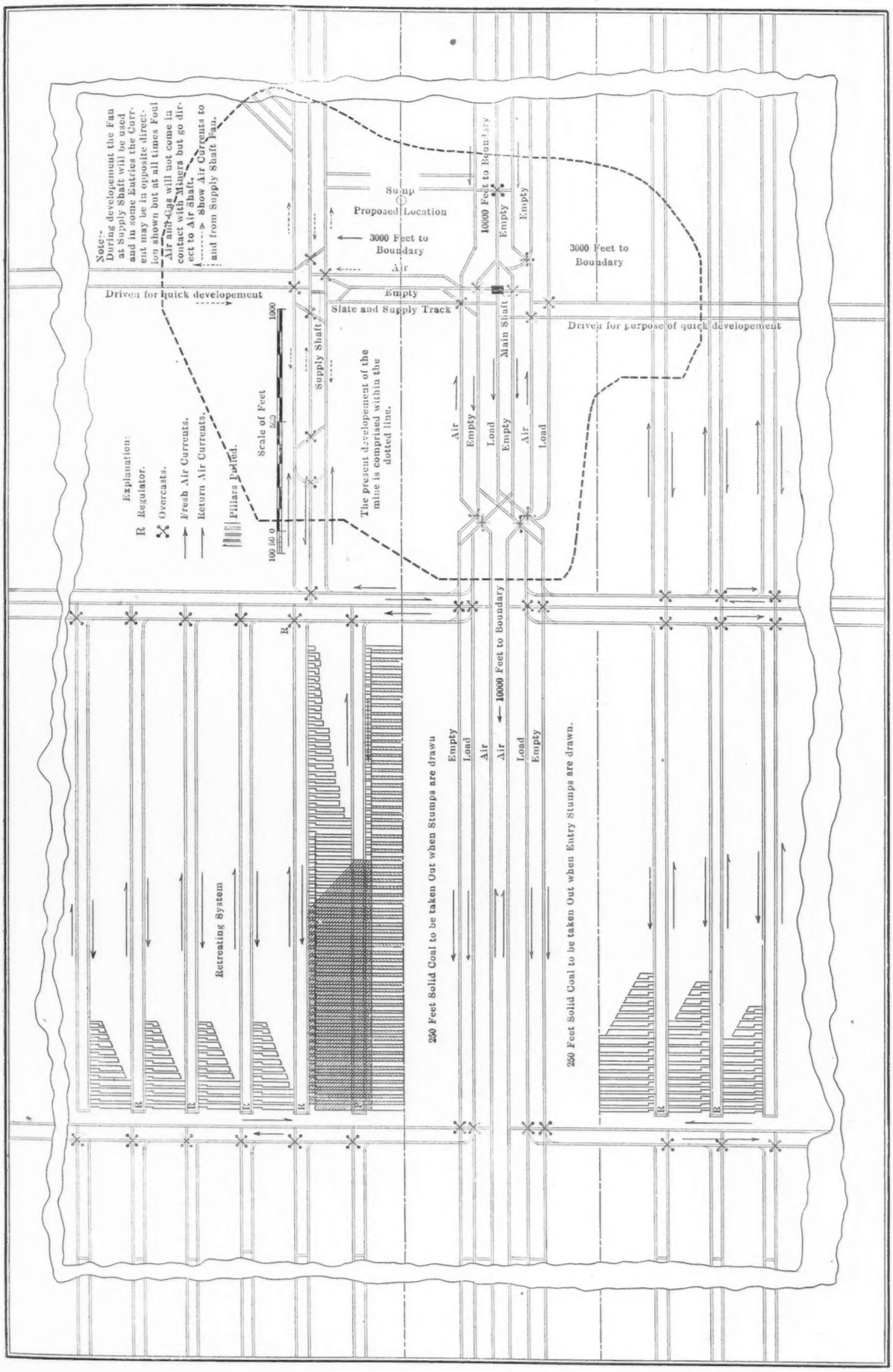
Up to the present point of development, the only work done in the Marianna mine is that of driving entries, which is commonly called "narrow work." Not a single room has been turned and driven. The general scheme of development is to work everything on the panel system retreating.

The entries so far driven are included in the dotted line surrounding the shaft on the drawing. Large barrier pillars have been left between each pair of entries, with still larger pillars protecting the outside entries. As is evident from the map, the development already accomplished extends only a distance of about 1200 ft. from the main shaft.

The System of Ventilation

In planning the ventilation for this mine, trap doors have been entirely eliminated and overcasts are used to carry the currents of air to the return. Overcasts are conceded by all mining men to be safer and eventually cheaper than trap doors. The large fan shown in Fig. 3 is only a temporary installation and will be replaced by a ventilator designed to deliver more than 500,000 cu.ft. of fresh air per minute at the face of the workings. It is the intention of the company to place another fan at the second shaft which is shown fenced in in Fig. 4. This last view was taken immediately after the explosion and the temporary fence was placed around the shaft merely as a safety precaution. The fan at the Rachel shaft, shown in Fig. 3 was operated as an exhaust, the air being drawn in through the shaft in Fig. 4. It is not the ultimate intention of the company to use both fans at the same time, but rather to have one ventilator as a duplicate installation to be used in case of necessity for repairs or for emergencies. The plan inaugurated, is to have not more than 50 men working in each section or panel, and every panel is to be ventilated by one current of air.

FIG. 1. TEMPORARY TIPPLE AND HEAD FRAME OVER MAIN SHAFT AT MARIANNA. TOP OF HEAD FRAME SHOWS EFFECT OF EXPLOSION


Note:-
During developement the Fan at Supply Shaft will be used and in some Entries the Current may be in opposite direction shown but at all times Foul Air and Gas will not come in contact with Miners but go direct to Air Shaft.
Show Air Currents to and from Supply Shaft Fan.
Explanation:
Regulator.
Overcasts.
Fresh Air Currents.
Return Air Currents.
Pillars Pulled.
Scale of Feet
100 50 0 100 200 300 400 500 600 700 800 900 1000
Sump
Proposed Location
3000 Feet to Boundary
Air
Empty
Slate and Supply Track
Driven for quick developement
Supply Shaft
The present developement of the mine is comprised within the dotted line.
10000 Feet to Boundary
Empty
Empty
3000 Feet to Boundary
Driven for purpose of quick developement
Main Shaft
Air
Empty
Load
Empty
Air
Load
Retreating System
250 Feet Solid Coal to be taken Out when Stumps are drawn
Empty
Load
Air
Air
10000 Feet to Boundary
Load
Empty
250 Feet Solid Coal to be taken Out when Entry Stumps are drawn.

MAP SHOWING GENERAL PLAN OF DEVELOPMENT AS OUTLINED FOR MINING THE COAL SEAM AT MARIANNA. THE ENTRIES ALREADY DRIVEN ARE INCLUDED WITHIN THE DOTTED LINE

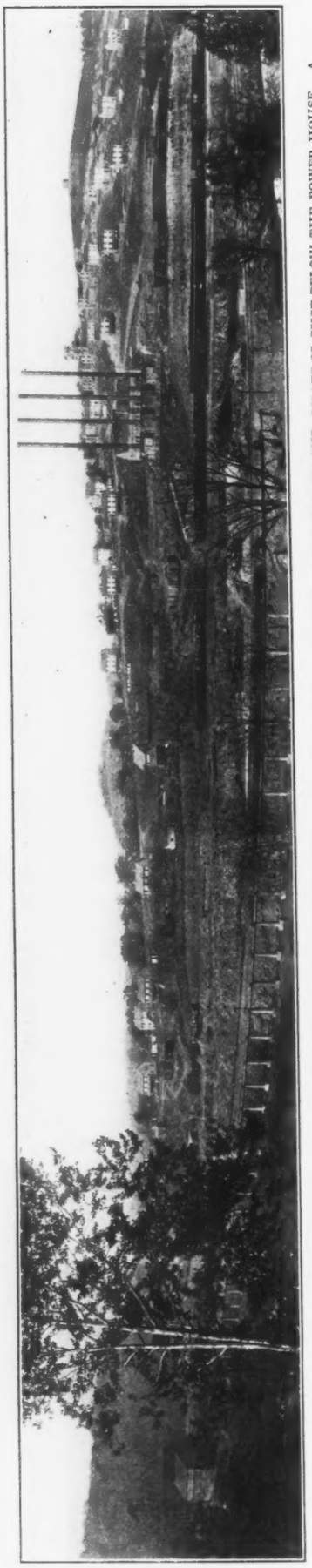


FIG. 2. SHOWING GENERAL VIEW OF MARIANNA PREVIOUS TO EXPLOSION. THE MAIN SHAFT IS AT LEFT OF PICTURE WHILE THE SECOND SHAFT IS JUST BELOW THE POWER HOUSE. A GAS WELL DERRICK IS BEHIND THE LARGE TREE AT RIGHT OF MAIN SHAFT

The First Shaft was Begun in May, 1906

The sinking of the shafts at the town of Marianna was begun in May, 1906, and completed in the latter part of 1907 and the early part of 1908. As an example of the modern and thorough manner in which the company has started to develop this property, I may state that the miners' houses will be built of brick and contain four, six and eight rooms each. Each house is to be electric lighted and furnished with a bath. The town is also to be sewered and lighted by electricity. The mine is designed to give employment to 5000 men, which will insure a population in the town of Marianna of from 10,000 to 20,000 people.

The Rachel shaft is 460 ft. deep and is 20x31 ft. in the clear. The pump and stairways are 4x20 ft., the cageways each 6 ft. 2 in. by 20 ft. in the clear, and the airway is 10x20 ft. It is the intention of the company to hoist two steel mine cars at one time, and with an average of 1250 hoists in eight hours, the capacity will be 10,000 tons daily.

The Mine was Visited this Fall by the Foreign Experts

When the expert engineers from England, Belgium and Germany visited our country this past fall, they included the Marianna mine in their trip of inspection; it having been selected as one of the operations near Pittsburg that was worth seeing. President Jones in receiving this visit of these mining men, presented each member of the inspection party with a detail description of the many advanced plans that were to be followed in the development of the property. This description which is too lengthy to be published here in detail is most convincing proof that the principal aim of the owners of the property was to here complete a mining plant which would be the equal of any similar operation in our country. Electric cutters are to be used in the mine, also electric lighting and haulage with a current of 300 volts. After the construction of the coke ovens is completed, the boilers are to be fired by the gases from these ovens.

The present tipple shown in Figs. 1 and 3, is only a temporary structure to be replaced by a steel building equipped with six dumps and an elaborate system of screens.

In concluding the prospectus before mentioned, which was given to the mine experts, Mr. Jones says: "On the whole, every known precaution will be taken to make the factor of safety a maximum, and in addition thereto many of our newly devised schemes will be added to reinforce the others." I have cited the foregoing to show not only the plan of mining carried on at the time of the accident, but to fully explain that the real keynote most pronounced in the development of the property was the single idea of efficiency and safety.

Details of the Accident

The explosion occurred at 10:52 on the morning of Saturday Nov. 28. Mine Inspector Henry Louttit made a trip of inspection through the mine that morning and came out of the workings about 30 min. before the explosion occurred. Mr. Louttit found everything in the mine thoroughly satisfactory and immediately on reaching the surface made an examination of the fan and the air entering the mine. At the time of this examination the water-gage stood at 3¼ in.; the fan revolved at a speed of 120 r.p.m. The examination of the air at the upcast shaft showed that about 190,000 cu.ft. of air was being drawn through the mine. After completing this examination Mr. Louttit went to the power house to look at the engines and see that all provisions of the law were here being complied with. While in the power house, Inspector Louttit heard the explosion, and immediately hurried from the power house to the shaft; it was readily evident just what had happened and Mr. Louttit's first examination was of the fan.

This inspection showed that the fan had stopped and the problem then was to determine whether the fan should be continued as an exhaust or reversed to blow air into the Rachel shaft. The latter course was decided upon and Inspector Louttit firmly believes from the subsequent results and the saving of the life of one of the miners that this plan of reversing the fan was the proper thing to do.

Efficient Aid Extended by Members of the U. S. Geological Survey Testing Station

Among the first rescuers on the ground were several of the engineers connected with the U. S. Geological Survey Testing Station in Pittsburg. These men were equipped with rescue apparatus of the Draeger type and soon instructed volunteers in the proper use of these safety devices. Great progress in advancing into distant parts of the workings was quickly made by those rescuers equipped with the life-saving apparatus. This is practically the first opportunity offered the experts at the testing station to be of real service, and there is no doubt but that their heroic work resulted in much good and was greatly appreciated by the officials and inspectors in charge of the rescue operations.

The Marianna mine contains small quantities of gas at the face of the workings, but there were no evidences that the property was unusually dangerous. It was also generally known that the region surrounding Marianna was within the natural-gas zone, and one of these wells had been drilled only a short distance from the main shaft of the mine. In Fig. 2, the derrick of this well can be seen through the foliage of the large tree at the left of the picture, and in the foreground. Immediately after the explosion, a story

was widely circulated that the mine workings had encountered a large pocket of gas which had been tapped by this well. This theory, however, like many other early surmises, has yet to be proved. It was also stated that the explosion was caused by a windy shot, which story if true, will probably be brought out in the coroner's inquest.

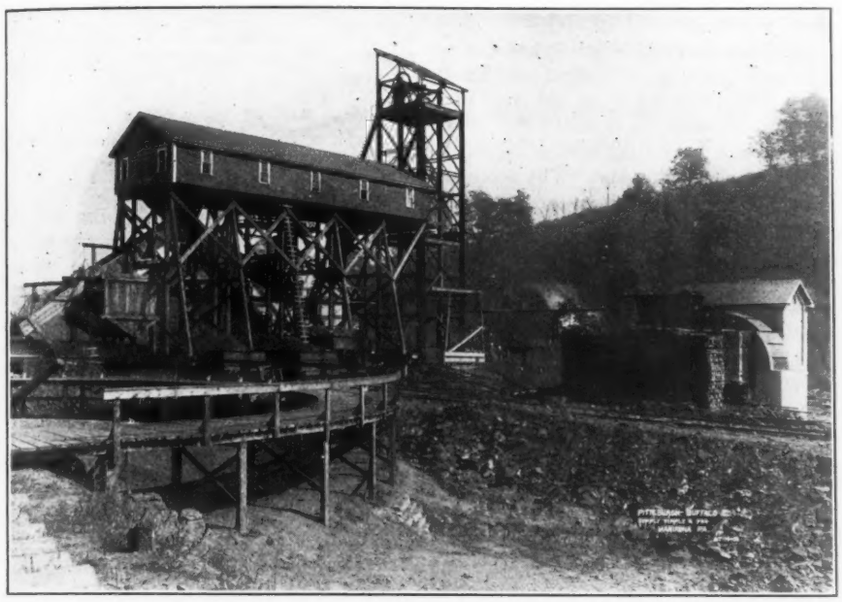


FIG. 3. TIPPLE AND TEMPORARY FAN AT THE MARIANNA MINE

The greater number of recent coal-mine explosions have shown clearly that dust has been the principal factor in sustaining and carrying forward the force of the initial explosion. In this accident, however, from preliminary and incomplete facts, it seems that gas has played the more important part, although dust has perhaps added somewhat to the force generated.

Conflict of Opinions

As is always the case in the event of such a disaster, there are any number of conflicting statements. Several witnesses who were present on the surface at the time of the accident differ in their opinions as to the number of reports that were heard. One man with whom I talked stated that he distinctly heard three successive rumblings, while other witnesses are as positive in their statements that but one report occurred.

It was the custom in the mine to use safety lamps at all dangerous points, while naked lights were largely used in other parts of the workings. This practice of requiring safety lights in a mine where electricity is used has been frequently condemned as most inconsistent; this question, however, was well answered by one of the inspectors with whom I talked, when he stated that "electricity exists only where you put it, while a naked light occurs where you take it."

The Statement that the Fan was Stopped Prior to the Explosion

On November 30, it was stated by one of the company's employees that a 2-in. steam pipe which operates a ring-pump 80 ft. down the main shaft, burst at the top of the shaft at an "ell" connection. It is asserted that the mine superintendent ordered the power shut off until the break could be repaired. I immediately dismissed this theory as being unworthy of consideration as several of the company's officials assured me that there was no basis for the belief. On Friday, December 4, I saw the fan indicator card which plainly showed that the fan stopped at about 10:27 on Saturday morning, Nov. 28. A careful investigation also showed conclusively that the explosion occurred about 10:52 Saturday morning. This indicated that the fan stopped 25 min. before the explosion occurred.

My notes, as before stated, showed that Mr. Louttit, the mine inspector, came out of the workings about 30 min. before the explosion was heard, so that if the ventilation was shut off before the accident, as the indicator diagram showed, the fan must have been stopped immediately after Mr. Louttit's inspection on the surface had been completed.

At a subsequent interview I was positively assured by those in authority that although the indicator card showed that the fan had stopped 25 min. before the explosion, that the clock governing the indicator diagram was about 25 min. slow, and that ventilation had not stopped until the explosion occurred. I also learned from the same reliable source that the indicator card was held by but one thumb tack, placed in the center of the card, and that for this reason it was possible the card had slipped a sufficient distance to account for the interval of 25 min. between the stopping of the fan and the occurrence of the explosion. The indicator card that was used at the time of the explosion was removed immediately after the explosion and a new card inserted in its place.

FIG. 4. VIEW OF SECOND SHAFT AFTER EXPLOSION. A TEMPORARY FENCE HAS BEEN BUILT AROUND THE SHAFT

If the fan did stop 25 min. before the explosion, this would probably have given sufficient time for the mine atmosphere in some entries to have reached a dangerous point, and the gaseous mixture could then have been ignited by a naked light or perhaps from one of the mining machines. This is pure guessing, however, and as I

have confined myself solely to facts about which there is not the slightest doubt, I will refrain from theorizing in the hope that the evidence presented to the coroner's jury will clear up all disputed points.

In conclusion, I may say that the location of the victims who perished in the explosion will be of considerable importance in substantiating or disproving that the fan was stopped. It seems incredible that the ventilation could be shut off for 25 min. before the accident without many of the miners noticing the lack of air and leaving their working places to investigate the cause. It is to be sincerely hoped that all charges of negligence and other criticisms of the company will be thoroughly dismissed when the correct evidence is presented. There is absolutely no doubt but that the highest officials of the company had endeavored to make the Marianna mine a safe operation. Mine foremen, in their eagerness to make a good showing, sometimes take chances in rushing entries too far ahead of crosscuts, just as miners themselves often face unnecessary danger in neglecting precautionary measures, so that they may get the maximum tonnage for the day. In the case of the Marianna mine, the entries were, in some instances, considerably ahead of the crosscuts; however, the mine inspector himself is authority for the statement that brattices were built up the center of all such entries, and that these brattices were kept within from 12 to 15 ft. of the face.

From Thursday morning until the explosion occurred Saturday, the barometer at Marianna rose steadily, registering an advance of ½ in. Conditions, therefore, were rather unfavorable to a gas explosion.

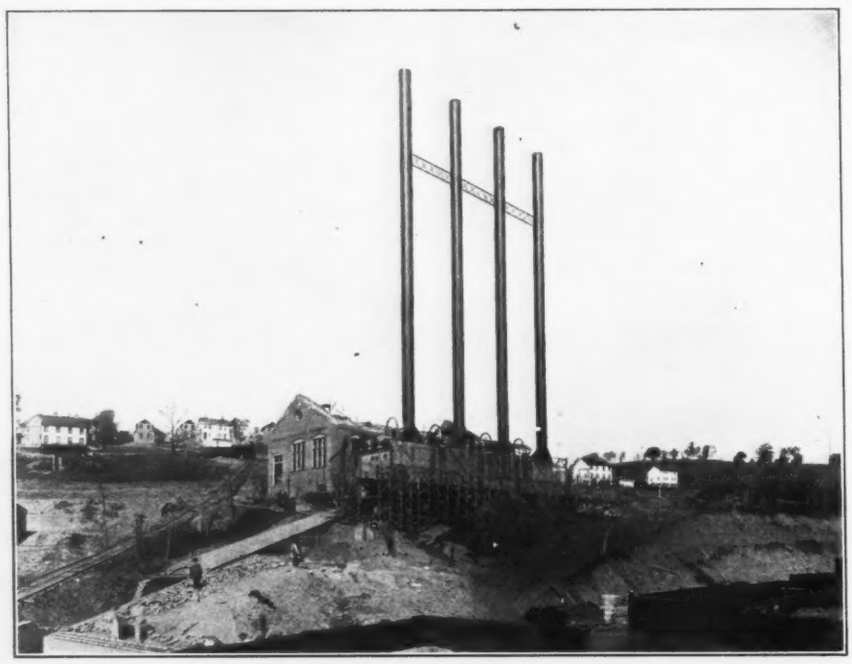


FIG. 5. POWER HOUSE AT MARIANNA DURING CONSTRUCTION

Colliery Notes

Expansion joints of steam pipes in a shaft should be brass lined on the sliding surfaces. Where the pressure is over 40 to 50 lb. per sq.in., such an expansion joint must be tied together by means of long bolts to limit the amount of movement in the joint.

At Arley colliery, North Warwickshire, England, workmen at a depth of 1020 ft., came across the bed of an old river more than 450 ft. wide; it is stated that at one point the stream runs into a lagoon or lake of considerable size. The river and lake have either dried up or have been diverted by some huge upheaval.

The life of mules and horses in our coal mines is anything but pleasant, and as a consequence, every effort made to benefit the lot of these animals is most commendable. A practice that might be successfully followed in this country has been inaugurated in England, where extraordinary enthusiasm was aroused by the parades of pit ponies, and thousands of pitmen with their wives and families, crowded around the ring where the little animals were judged. Each pony was attended by a pit boy, and all the animals wore the harness in which they work in the mines; they were also equipped with the skull-caps of stout leather which they need to prevent them from cutting their heads as they draw the cars of coal along the low entries. Various prizes were awarded to the different collieries whose animals were in the best order. Many of the ponies that were exhibited had been underground for five or six years and were a little dazed by the brilliant sunshine. In showing what good care will do for a pony that is used underground, mention was made of one pony which was taken down in June, 1887, 21 years ago, and has never since seen daylight. This animal continues to work eight hours a day and is still in fine condition. Exhibitions of this sort if started in our own country would do much to create a better feeling toward the animals now used underground.

Where rotary tipplers are used, the coal should not be dumped from the car onto a screen without some means of preventing the coal being thrown forward. This practice of dashing the coal on the screen is not only detrimental to the coal itself, but lessens the efficiency of the screening. Instead of having the rotary tippler revolve toward the screen, it should be arranged to turn backward, a circular plate being provided to receive the coal. The tippler should also be provided with a hood which accurately fits close to the circular extension of the screen, so that the coal is first received in the hood and gradually discharged upon the screen. It is also most important that the tippler should turn as slowly as possible. Many tipplers revolve too quickly, with the result that they stand several seconds, between each car; it is better to occupy more time in turning and thus insure less breakage. The best plan is to install an extra tippler rather than lower the selling price of the coal by having one tippler working at its maximum capacity and handling the coal roughly.

The committee appointed by the English Government to investigate the accident which occurred at the Roachburn colliery, Cumberland, England, early this year, has just submitted its report. In this accident three men lost their lives and 130 other miners barely succeeded in escaping to the surface. The bodies of the men entombed could not be recovered, and as a consequence, no inquest was possible. In the report of the inspectors, it is stated that the accident was caused by working the coal up to the outcrop at a point where the surface deposits were so saturated with water that they gave way and poured into the mine, the quantity being estimated by the manager to be about 90,000 cu.yd., forming a subsidence or cavity on the surface extending over nine acres and having a depth of 49 ft. The most interesting fact concerning this disaster is contained in the statement that the inflowing materials passed downward into the mine, and extended a distance of 2240 yd. by the shortest route to the bottom of the exploring dip. The sudden inflow of water into a mine has been known to overtake and destroy many miners, but this is one of the first instances where fluid moss has been known to flow with such rapidity. As a result of extending the workings so close to the outcrop under such surface deposits, the entire colliery is lost to the owners, besides the fatalities that resulted to the men.

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Colliery Accidents

In an impassioned address at Pittsburg, last week, John Mitchell expounded the views of organized labor as to the great question of conservation of life and limb in coal mining. The reduction of the disgraceful loss of life that has occurred in American coal mining is a subject upon which everyone may meet upon the common ground of humanity, but opinions differ widely as to the paths to the meeting place. John Mitchell takes a path that leads through pitfalls, bogs and quagmires, and abruptly comes to an end —in short, a blind alley—yet among his specious reasoning and misstatements there are glimmerings of sense.

He argues, in the first place, that the price for coal is too low. He does not want the domestic user to pay more. Indeed he considers that this class of consumer pays too much already. But on the other hand there are large consumers who do not pay enough. The addition of a few cents per ton to the general average would enable colliery operators to mine their coal more safely. Undoubtedly that would be so. Probably, moreover, many large consumers at present obtain their coal too cheaply. But how is this condition to be changed? How is the price for coal to be raised in an industry which enjoys such unfettered competition?

Mr. Mitchell does not accede to the views of some persons that a solution of this sad problem will gradually work out, and we must be patient in the meanwhile. He thinks that the evil ought to be corrected right away. In this we agree with him. Mr. Mitchell says that the danger of loss of life by explosions can be eliminated immediately by taking the men out of the mine, in other words, by employing shot-firers, at a cost of not to exceed 2c. per ton of coal. On its face this suggestion looks well. Certain States, Illinois for example, have already tried the expedient of making the employment of shot-firers compulsory. The defect of this procedure is that the shot-firer must not only explode the charge, but also must load all the holes if an extraordinary mortality among shot-firers is to be avoided. The miner who is not going to shoot his own charge is apt to be careless how he loads it. Nevertheless, there is a way around this difficulty, viz., the employment of electric shot firing, already introduced in a number of collieries with success and at an expense of only about 2c. per ton of coal, which Doctor Douglas reports as the experience at his colliery at Dawson, N. M. Electric shot firing eliminates the danger of loss of life by gas or dust explosions, and if properly supervised there need be no great danger of blowing up the whole mine, as happened in an early trial of this method in Utah. We advocate the further employment of electric shot firing, and insofar as taking the men out of the mine is concerned, when that method is employed we agree with Mr. Mitchell.

We do not agree with Mr. Mitchell in his specious reasoning that the operation of collieries is safest with organized labor. Although he supported his contention with statistics showing that the loss of life is greatest in West Virginia, where the union has least hold, we may point out that (1) conclusions should not be drawn from the experience of a single year in which some extraordinary disasters occurred in West Virginia; and (2) comparative statistics fail to show differences in mining conditions, the mines of West Virginia, for example, being notoriously more gaseous and more dusty than those of Missouri. Instead of unionized labor being a panacea for safety in coal mining, we believe that it is one of the factors contributing to danger. When the operator is able to dismiss an employee for breach of discipline without risking a strike, a great step toward safety will have been accomplished.

What then shall be done to counteract the dangerous ignorance of the foreign horde that we employ in our coal mines? Dictation by the union, which Mr. Mitchell suggests, is surely the last thing that will enter the mind of any intelligent operator. Not that, but rather the expedient which Dr. Douglas suggested, with his characteristic keenness of perception and clarity of thought, namely, the employment of more bosses, who will see that the unskilled miners do not break rules and endanger their fellows. This also would increase the cost of coal, which in the opinion of Dr. Douglas ought to be met by the consumers. Again, we agree.

Dr. Douglas came near to the real solution of the difficulty, which Mr. Mitchell does not see at all. This is the enforcement of our laws by adequate inspection, and the unbiassed determination of blame for disobedience and carelessness of the laws, whether by operators or miners. Let Mr. Mitchell and his union make this their

slogan. Not the employment of shot-firers, the unionization of labor, and State indemnity for accidents covered by a tax on the coal product (which would be unconstitutional as class legislation); but rather the appropriation by the respective States of such sums of money as will provide for severe mine inspection, the appointment of experienced and honest mining engineers as mine inspectors, free from political and all other kinds of influence, the *enforcement of the laws*, the abolition of the absurd coroner's jury, and competent means for fixing the blame for accidents. If this were done, everyone would be surprised at the speed with which our mortality rate would decline. The statistics show how much room there is for betterment in this respect. During the last 10 years upward of three American miners out of every 1000 employed have been killed annually. In Europe the rate is but little more than 1 : 1000.

The ignorant, and those who seek to pull wool over the eyes of the ignorant, talk about the mysterious conditions that exist in coal mining. A lot of this was heard at Pittsburg last week, which finally led the National Institute of Mine Inspectors to enter a protest, distinguished for its sanity amid the flood of wild talk. There is nothing mysterious about the conditions in a coal mine. The technologic branch of the U. S. Geological Survey, with its elaborate experimental station at Pittsburg, is going to arrive at a good deal of data that will be of value to engineers, but it is not going to unveil any mystery, or inaugurate a new era of safety in coal mining, although Mr. Mitchell and some politicians who spoke at the opening ceremonies may think so, or pretend to think so. Everybody who has had any experience in coal mining knows that a mixture of methane and air will explode; also that dust in suspension in the air will explode under certain conditions. Moreover we know well enough what those conditions are and how to obviate the danger. The trouble is simply that knowing this our operators become careless and take chances.

The great explosions—Monongah and Marianna—which more than anything else have aroused public sentiment in 1908 were in no way mysterious. They were not "acts of God." They were acts of carelessness by man. The coroner's jury decided that the Monongah explosion was due to a blown-out shot, making it consequently "an act of God," for which the company was not responsible, either legally or morally. The JOURNAL expressed the opinion, after an examination on the ground immediately following the explosion, that the cause was a runaway trip of cars. This was also the report of the mine inspector for the district. We have not had any reason to change our opinion, although in holding it we have stood alone in America, at least so far as public expression goes. However, we have had the endorsement of M. Taffanel, directing engineer of the French experimental station at Lièven, who came to America especially to study the cause of this explosion and arrived at the same conclusion that we did.

The more recent Marianna explosion was at first regarded as exceptionally mysterious. Here was a loss of life in one of the model mines of Pennsylvania, which moreover occurred within less than an hour after the mine had been examined by the inspector for the district and had been pronounced safe. Surely, it was said, this was an "act of God" if ever there was. However, we found upon investigation that there had been an accident to a steam pipe in the shaft; while repair was being made it is alleged that the fan was stopped and the explosion occurred while the fan was stopped. The mine was known to be gaseous and safety lamps were supposed to be employed exclusively in it; but—carelessness again—there were some naked lamps.

We do not yet say that the Marianna explosion occurred because the fan was stopped. The recording diagram shows that it did stop at about 10.27 a.m. The explosion happened at about 10.52 a.m. Officials of the company deny that the fan was stopped at the time of the explosion and claim that the clock of the recorder was slow, or that the record-paper slipped! All that we pronounce at present is that when the real investigation has been made—quite irrespective of the finding of the coroner's jury, which probably will be as farcical as usual—the Marianna explosion will be learned to have been due to carelessness by someone, somewhere.

Here, then, we have the solution of the problem: 1, Electric shot firing; 2, more bosses; 3, non-interference with discipline by the union; 4, adequate inspection; 5, enforcement of the laws; 6, intelligent adjudication of blame; 7, legal collection of damages. Let Mr. Mitchell and his union consider this and act accordingly. Let the operators meet him on this ground.

Has the Value of Gold Depreciated?—A Correction

In the article by Mr. Ingalls in the JOURNAL of Nov. 28, it was stated that "the fixity of the value of an ounce of gold at $20.67 is arbitrary, resulting from the dictum of Congress in 1792 that 270 grains of gold, 916⅔ fine (equal to 247.5 grains of pure gold), shall be stamped $10." Our attention has been called to the fact that according to these figures the value of an ounce of gold would be $19.39. Mr. Ingalls made an error through overlooking the change that was made in the weight of the American gold dollar.

The Act of April 2, 1792, provided for the coinage of eagles, each to be of the value of $10 or units, and to contain 247.5 grains of pure gold, or 270 grains of standard gold. By the Act of June 28, 1834, the weight of the eagle was reduced to 258 grains, of which 232 grains were to be pure gold. The Act of Jan. 18, 1837, did not change the gross weight of the coin, but caused the fineness to be 0.900.

The reference to the old English act stamping 113 grains of fine gold as £1, which was intended to be figurative, is, of course, incorrect if construed literally. The present gold standard was adopted in England in the 14th year of the reign of George III. Although accounts were kept in England in pounds, shillings and pence, the pound was not coined until after the Act of 1816. Previous to that date the English gold coin was the guinea of 21 shillings.

Of course, these figures were merely introductory, and the error as to how the value of an ounce of gold is established at $20.67 had no effect upon the argument of the article.

THE ESTIMATE of the iron ore resources of the United States made by the National Conservation Commission appears to be open to exceptions. The Commission does not say where the line between "high-grade" and "low-grade" ores is to be drawn. An important part of our iron industry has been built upon what some miners would call low-grade ores; such ores are yearly coming into increased use, and with improved methods and increased attention to economy in smelting, there is no reason to fear that we shall be depending upon imported ores by "the middle of the present century"—or at a much later date.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

A Gas Analysis Will Answer This Question

This mine, at Dorchester, Colo., has a tunnel something more than a mile long, running into a mountain of granite, porphyry, trachite, aplite, etc., much faulted and somewhat metamorphosed. After standing idle for eight months the tunnel was found to be so filled with gas that a light could not be taken into it. For several days air was pumped into it, but without improving its condition; so a suction pipe line had to be run to the breast before a light could be kept there. During the first few days after mining was commenced several men at different times were "knocked out by the gas." Some had to be carried out.

A raise was started soon after the mine was opened. After getting up 60 ft. trouble began to be experienced with the light. When the air got so bad that a candle would not burn, an inch pipe was run up, and compressed air blown in until the light became normal. This served the purpose until the raise got up another 40 ft. Then it was found that no matter how much air was blown into it, a few minutes after the air was shut off the light would go out; and a considerable amount of air constantly driven in hardly kept the light burning.

A branch from the suction pipe was carried up into the raise. The air was again good, but only when the suction pipe was kept within 20 ft. of the top of the raise. This raise has now been abandoned, and the pipes removed. A light cannot be kept in it, and a person cannot remain in it more than a minute without beginning to feel dizzy, the first sympton of becoming "knocked out" by the gas.

It has been suggested that this condition was due wholly or in part to the improper decomposition of the dynamite used, due perhaps to its being insufficiently thawed. Du Pont 40-per cent. powder was used. No such experience with gas has been experienced of late, but giant powder is now used, as it thaws more easily.

It is apparent that the gas in question is decidedly lighter than air; it does not readily mix with air; and it is generated in the mine.

What is this gas? Can it be a product of the explosion of the dynamite? Being so light this does not seem probable. Can it be helium coming up through the rock? If it were hydrogen or marsh gas, would it not intensify instead of deaden the light?

ARTHUR O. CHRISTENSEN.

Dorchester, Colo., Nov. 21, 1908.

The Thickest Coal Seam

In the JOURNAL of Nov. 21, 1908, an inquirer asks information regarding the thickest coal seam in the United States, and is answered by the description of a seam or bed of coal from 40 to 65 ft. in thickness at the little Grizzly mine in North Park, Colorado.

Wyoming can go one better for thickness. At the Prospect tunnel near Kemmerer, Uinta county, Wyoming, close to the Idaho line, the Oregon Shortline railway passes through a vein of pure lignite coal 84 ft. thick with one parting of clay 2 in. thick. On account of its poor shipping qualities, this coal has never been worked. It occurs in the upper Montana division of the Cretaceous formations, and is fully described with analyses in the report of the "Geography and Geology of a Portion of Southwestern Wyoming with Special Reference to Coal and Oil," by A. C. Veatch, of the U. S. Geological Survey, Professional Paper No. 56, p. 131. R. N. B.

Boise, Idaho, Dec. 1, 1908.

Ironing Reverberatory Furnaces

The mistaken idea of plating the sides of reverberatory furnaces with an aggregation of I-beams, limited only in number by the closeness with which it is possible to set them, cannot be too strongly condemned. Many constructors have been guilty of such work, some even have been known to use practically a continuous plating of 7-in. or 8-in. I-beams for this purpose; that too, in cases where there was no reason why the 15-in. size should not have been used, with its correspondingly greater economy. If a supporting covering is absolutely required, nothing will give greater satisfaction than a ribbed cast-iron or steel plate. The former is cheaper, and answers every purpose. If made of ¾-in. metal, with properly spaced ribs, it will answer far better than any number of small I-beams, and cost vastly less. It must be understood that the side ironing, that takes the strain brought upon the walls by the molten contents of the furnace is here referred to. In this connection the point may be raised that the use of deep I-beams near the doors may interfere with operations; but this can be easily obviated by framing horizontal beams above and below the doors, connecting them to the vertical buckstays. Indeed, horizontal beams, between vertical buckstays allow the use of the material to rather better advantage than using vertical buckstays entirely; this is especially true of large furnaces, in which the economy is susceptible of easy demonstration, even when the additional 0.25c. per lb. for framing is considered.

New York, Nov. 30, 1908. G. J. H.

Elmore Vacuum Process at Broken Hill

On page 896 of the JOURNAL of Nov. 7, 1908, Gerard W. Williams, in his interesting article on "Metallurgy of Broken Hill" is made to say, "The Zinc Corporation, which purchased tailings from many companies, has so far proved a dismal failure."

This statement is in direct opposition to the actual facts, and as it is likely to reflect on the reputation of the Elmore process, the patents for which we control, we would ask you to be good enough to publish this letter.

As a matter of fact, the Zinc Corporation expended large sums of money and much time in successively trying on a large working scale, three different "flotation" processes, each of which in turn hopelessly failed. It is perhaps to these failures that Mr. Williams refers.

Following these failures the Elmore vacuum process was installed and yielded highly satisfactory results from the moment of its being put into operation.

The Elmore plant has now been running regularly night and day for about nine months, and is treating about 16,000 tons per month resulting in a gratifying profit, notwithstanding the low prices prevailing for zinc, lead and silver at the present time. It may interest readers of the JOURNAL to know that the standard 5-ft. Elmore machines of estimated capacity of 35 tons per 24 hours at the Zinc Corporation plant have been proved to have an actual capacity of 70 tons per 24 hours.

J. STOCKER,
Secretary, The Ore Concentration Company (1905), Ltd.

London, England, Nov. 18, 1908.

D. Anderson, secretary of the Zinc Corporation, Ltd., in a letter to the Australasian Syndicate Ltd., states that:

"After exhaustive trials with a standard 5-ft. Elmore apparatus, this company determined to erect 16 such machines. The plant has been in regular operation for about nine months, giving a greater capacity than the trials with the one unit indicated as possible.

"The plant is now treating about 15,000 to 17,000 tons of tailings per month producing therefrom about 5500 to 6800 tons of concentrates per month. The Elmore machines give no trouble in operating by the usual labor available."

[The article in question remained in our hands several months before its publication and previous to that was several weeks in its transit from Australia. At the time of his writing Mr. Williams was probably justified in making the statement, which, however, was unjustified at the time of the publication. The reviser of the manuscript should have eliminated the statement. We tender our apology to the Zinc Corporation, to the Ore Concentration Company, Ltd., and to our readers.—EDITOR.]

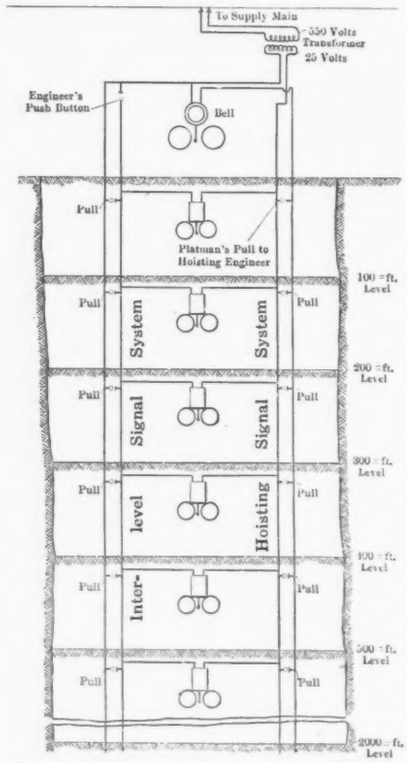
Electric Signaling at Mines

In the Mines Regulation act, 1906, of Western Australia, a system of return signaling is made compulsory. This provision has caused considerable objection on the part of mine operators in that State in spite of the fact that there are several successful installations of return-signal systems used in the mines of that State, especially that invented by Grayson and Glew, which is used at the Great Boulder Proprietary mine, Kalgoorlie. Before describing this installation, A. Montgomery, State mining engineer, in the report for 1907 of the Department of Mines, Western Australia, makes the following general comments on the question of mine signaling:

"Objection is taken to return signals being made compulsory. The history of Mines Regulation acts everywhere, however, bears out the contention that it is necessary to insist by legislative processes upon safeguards being introduced into mines before there is any very general disposition to supply them. Return signals are now insisted upon in many mining countries, and have proved a great additional safeguard to the workmen wherever they have been installed. The experience with them in this State has been highly satisfactory wherever a really good return-signal installation has been introduced. After much investigation and discussion of the subject I am fully convinced that the requirement of such signals is a proper one, and one which ought to be insisted upon in all large mines. In the smaller ones there is not so much liability to confusion of signals, and the same necessity does not, therefore, exist for repetition of them before the cage is moved, but in these also it is of much advantage. In the small mines it is a simple matter to arrange return signals by means of knocker lines, similar to those used for signaling from underground to the engine room. In the big mines various systems of electric signaling are being very generally introduced, which render signaling more easy and more rapid and permit good return signals to be readily made. Several of the large mines at Boulder are now equipped with electric signal systems, the latest installation being that at the Great Boulder Proprietary mine, where what is known as Grayson and McGlew's patent has been put in."

RETURN-SIGNAL SYSTEM, GREAT BOULDER PROPRIETARY MINE

In the system installed at the Great Boulder Proprietary mine an alternating



ELECTRIC SIGNAL SYSTEM, GREAT BOULDER PROPRIETARY MINE

current transformed to 25 volts is used, and two separate signal wirings are installed, one for the return signals from the engineer and for signaling from the different levels to the cager or platman, as he is called in Australia, the other for signaling to the engineer. Thus the engineer receives signals only from the platman, his bell being silent when a person underground is signaling from one level to another, so that the engineer is less liable to become confused by the signals. In the shaft a steel-armored, lead-protected, jute-covered cable, in which are eight No. 16 wires, is used. The cast-iron junction boxes used are made at the mine. These are rendered water-tight by pouring melted paraffin into them. The doors are also protected by a rubber-cord luting. "Mix and Genest" pulls are used, and Siemens-Halske polarized bells. An accompanying illustration shows the wiring of the system. the Great Boulder Perseverance shaft is 2230 ft. deep, and this signal system connects with each of the 27 levels.

Traveling Cranes

In buildings supplied with traveling cranes the ordinary I-beam or channel is frequently used as a crane girder, and the crane wheels often run directly on the top flange. A point that is often lost sight of in designing work of this kind is the necessity of lateral support for the top flange of the beam that is used as a crane girder. If the width of flange is more than one twenty-fifth the span such stays may usually be omitted, but even then the fact that steel beams and channels are rarely straight enough to form a satisfactory track operates against the efficiency of the design. Beams used for this purpose should always be regarded solely as a support, and not used as a runway for the crane wheels. A separate rail should be provided for the latter, not necessarily of the T-section which sometimes takes up valuable head room, but it should be of such a type that it may be readily placed in position with a minimum amount of field work. An ordinary "flat" that is secured through holes in the top flange of the girder itself gives about as satisfactory a medium for this purpose, at minimum cost, as is desired. The holes should usually be punched in the top of the beam and drilled in the field through the plate after the latter has been lined up to the proper gage.

Another method of procedure, if bolts are used for fastening, is to punch holes in both top flange and plate. Those in the latter are slotted transversely of the plate itself, so that inaccuracies of gage may be corrected. This is one of the simplest points about crane girders for use in small work, but it is also one of the most frequently overlooked. The expense of adding these plates or rails after the structure is in position becomes very high, largely on account of the fact that it is practically all field work. The holes are usually placed on one side only, of the center line of the beam, namely, that away from the flange of the wheel. Unless the wheel tread is broad, these fastenings need not be countersunk, but if the connection is made on both sides, that side under the tread must not only be countersunk but is also apt to be loosened by the passage of the wheel end of the crane itself. I-beams used for this purpose are often found to be at least an inch and a half out of line, and the plates should therefore be figured to extend one inch beyond the edge of the flange. This allows a certain amount to be taken up in fastening the crane rails, the added stiffness, imparted by the use of a flat plate for this purpose, accomplishes the rest by drawing the flange into line and keeping it there.

Sound Views of the Mine Inspectors

The mine inspectors of the coal-producing States take issue with the statement, oft repeated during the recent session of the American Mining Congress, that the great cause of explosions is unknown. Fifty inspectors held nearly an all-day meeting at Pittsburg on Dec. 4 to discuss the addresses made during the meeting of the congress. The result was the presentation of an address to the mining congress by the inspectors protesting against the broad assertion that mine disasters are a mystery. In addition, the inspectors have in preparation a series of suggestions for recommendation as to new mining laws for all the States in the central competitive field. Most important among these recommendations will be the declaration that stricter rules are needed for the sprinkling of dust before shots. They will appeal to the legislatures to force the keeping of a record of the dust sprinkling, similar to the fire bosses' records in the mines.

The address from the entire body of inspectors was presented to the congress by J. T. Beard, secretary of the National Institute of Mine Inspectors. It contained the following:

"The State mine inspectors present at this meeting desire to assert their belief that the causes of mine disasters are for the most part known, and that it will be possible by united efforts of all persons interested to greatly reduce the liability of explosions. It would be a grave error to allow the statement made in this congress that the general causes of these disasters are unknown to go unrebuked. There is no hidden mystery in these happenings, as some of the addresses heard at this convention would lead the average listener to believe. At all the recent explosions, with the exception of the last, at Marianna, the causes have been speedily ascertained and remedial measures recommended."

The West Virginia resolutions, submitted by Chief Ross and his 11 deputies, read in part:

"Whereas, there are but two elements found in our mines which have caused recent explosions—namely, coal dust and gas, singly or in conjunction—we, as members of the Department of Mines of West Virginia, recommend that laws be advocated to the end that the roof, sides and bottom of all dry and dusty sections be kept thoroughly wet by systematic watering; that a record shall be kept by the mine foreman or someone appointed by him of the amount of water used, time expended, sections watered, and dates of watering.

"That the excessive use of brattice at a distance in excess of 80 feet between breakthroughs makes it impossible to maintain adequate ventilation; and that the State Department of Mines must be empowered to conduct common-sense examinations for mine foremen and other officials, with power to revoke their certificates with sufficient cause."

Secretary Beard said, in presenting the two papers, that the inspectors did not mean to say that they already knew the cause of the Marianna explosion. That, he said, would be premature. "But it has been so strongly stated that these explosions are a mystery, and that we cannot expect to be free from them," added Mr. Beard, "that the inspectors felt such declaration should not be allowed to stand without refutation."

American Mining Congress

The 11th annual session was held at Pittsburg, Penn., Dec. 2-5, the meeting being in the Carnegie music hall. The morning of the first day was devoted to addresses of welcome and responses thereto. In the afternoon reports of the committees on prevention of coal-mine accidents, prevention of accidents in metalliferous mines, smelter rates, and the relation of the national forest service to the mining industry were made. The reports of the last committee drew out an interesting discussion. It appears that the mining industry has some real grievances against the Forest Service. However, the opinion was expressed that the Forest Service is doing its best to preserve the timber, and is feeling its way as to how far it may go; if the existence of evils because of going too far is called to its attention, the Forest Service will undoubtedly quickly correct them.

At the evening session Dr. James Douglas delivered a paper on "The Mining Industry as Influenced by Transportation." He was followed by Dr. George Otis Smith, director of the U. S. Geological Survey, on "The Distribution of the Nation's Wealth." A. H. Brooks, chief of the Alaskan Division of the U. S. Geological Survey, delivered a paper on "The Mineral Resources of Alaska." Each of these papers was illustrated by stereopticon views. They were valuable contributions to knowledge and were warmly received.

In the session of Thursday morning J. B. Zerbe, of Cleveland, Ohio, presented some rational ideas respecting the subject of conservation in the coal-mining industry. He was followed by John Mitchell, who made a forcible address upon the theme of conservation of life and limb in coal mining. This is taken up editorially elsewhere in this issue. Mr. Mitchell's address was followed by a general discussion, in which some illuminating ideas were offered .

In the afternoon the meeting adjourned to the arsenal grounds, where the U. S. Geological Survey has installed its station for the investigation of mine explosions, etc. Experiments have been going on at the station for several months, but this was made the occasion of the formal opening, addresses being made by Secretary Garfield, Dr. G. O. Smith, director of the Survey; Dr. Joseph A. Holmes, chief of the technologic branch, who is in direct charge of the station, John Mitchell, and others. Illustrations of the experiments that are being conducted were then made.

On Friday, Senator Charles Dick, of Ohio, delivered an address on the "Duties of the Federal and State Government in Relation to the Mining Industry." Dr. I. C. White, State geologist of West Virginia, read an important paper on the waste of natural resources in Pennsylvania.

This meeting of the American Mining Congress was well attended and was marked both by an improvement in the character of the attendance and the discussions which took place.

The Tariff Hearings

SPECIAL CORRESPONDENCE

At the tariff hearings on "Sundries" (Friday, Dec. 4), William B. Klee, president of the Damascus Bronze Company, Pittsburg, asked for the imposition of duties ranging from 3 to 7c. per lb. on phosphor-copper and phosphor-tin, the rate varying according to the amount of the phosphorus content of these metals. In lieu of this, free phosphorus with a duty of 1c. on the manufactured metallic product would be considered satisfactory. At the same hearing M. T. Garlow, of Grand Island, Neb., asked for an increase in the rate of duty on pumice from $6 to $11 per ton.

The Central Dyestuff and Chemical Company, of Newark, N. J., through George J. Prochazka, president, has filed argument for the maintenance of a 30-per cent duty on coal-tar colors. Zinkersen & Co., of New York, in the course of a discussion of the duty on coal-tar colors ask that coal tar be free, intermediate products like phenols, kressols, naphthols, etc., 10 per cent., with finished products like picric acid, carbolic acid, etc., 20 per cent., and aniline coal-tar colors 30 per cent. The New England Felt Roofing Works have filed protests against the imposition of any duties on coal tar or coal-tar pitch.

Several manufacturers of pyroxylin offer to assent to moderate reductions on collodion and all compounds of pyroxylin.

March G. Bennett, manager for Samuel Cabot, of Boston, has presented arguments for continuing creosote on the free list. The International Creosoting and Construction Company, of Galveston, Tex., has filed protest against the imposition of any tariff on creosote.

The Fresno (Cal.) Magnesite Company

has asked for duties of from 1c. to 7c. per lb. on magnesite at different stages of manufacture.

The Aluminum Company of America, Pittsburg, through Arthur V. Davis, its president, under date of Nov. 30, asks that the present tariff on alumina be retained. This request is supported by the Pennsylvania Salt Manufacturing Company, through Theodore Armstrong, its president.

The Henry Bower Company request the imposition of a duty of 5c. per pound on anhydrous ammonia in steel or iron cylinders; on sulphate of ammonia, 0.3c. per lb.; on prussiate of potash, 4c. per lb.; on prussiate of soda, 3.2c. per lb.; on sulphide of soda, 0.5c. per lb.; on tetrachloride of tin, 5.53. per pound.

Charles J. Staples, of Buffalo, has submitted argument in favor of a duty on crude barytes of $7 per ton. R. B. Dougherty, of Sweetwater, Tenn., asks for a duty of $5 per ton on the same product; while William A. Buddecke, for the Point Mining and Milling Company, St. Louis, has filed argument for a duty of $15 per ton on crude barytes. J. W. Coulston & Co., New York City, importers of paints, have recorded a protest against advancing the duty on crude barytes.

The Atlantic Terra Cotta Company, of New York City, protests against any duty on the imported carbonate of baryta, which is now paying 25 per cent. ad valorem.

The Conservation of National Resources

Special Correspondence

The National Conservation Commission began its meetings in Washington on Tuesday, Dec. 1, and remained in practically continuous session until Tuesday, Dec. 8, when the conservation conference was opened. The conference continued in session during the remainder of the week. At the meetings of the conservation commission reports on natural resources were prepared for submission to the conference and their discussion has occupied the bulk of the time of the latter body. Reports from all four sections of the commission have been presented.

Value of Mineral Production

On minerals the commission reports that the production of the United States now exceeds $2,000,000,000 per annum, furnishes light, heat and power, and supplies 65 per cent. of the freight traffic. Waste in mining and treating mineral substances is over $300,000,000 per annum.

Coal Resources

Approximately 1,463,800,000,000 tons represent the accessible supplies of coal in the United States. It is estimated that this supply will be so depleted as to approach exhaustion before the middle of the next century. The commission estimates that for every ton produced since coal mining was undertaken in this country half a ton has been lost or wasted. The first step recommended in extending the life of our fuel supply should be to lessen the waste in mining, handling and transporting coal, and to discover means of avoiding the losses involved in transforming heat into mechanical and electrical energy.

Iron-ore Supplies

Supplies of high-grade iron ores in the United States are estimated at 3,840,068,000 tons, which, it is believed, will not last beyond the middle of the present century. Before 1940, the commission thinks, production will have reached a maximum and begun to decline; resort must be had to low-grade ores, or there must be large importation of foreign ores. Petroleum, natural gas and high-grade phosphate rock cannot at the present rate last beyond the middle of the present century. Natural mineral resources used in building and engineering construction are being wasted in three ways: (1) by wasteful methods of mining and preparing for market, (2) by excessive use of structural materials due to ignorance of their qualities, (3) by fire loss due to inflammable construction and poor building laws. The greatest waste is attributed to fires and must be reduced by the use of fireproof construction. Total costs of fire of all classes for 1907 are estimated at $456,485,900 in 1907, or about 50 per cent. of the total value of the building construction of that year. The total per capita loss was $5.34. About 27 per cent. of the loss was due to fires extending beyond the building where they originated. Only $68,000,000 was lost on buildings of slow-burning construction while the loss on frame buildings was $148,000,000. About $234,193,000 per annum may be saved by making building construction in the United States as good as that found in foreign countries.

Public Lands

The Section of Lands finds that there are in the United States a trifle less than 3,000,000 sq.m., of which about one-fifth is under cultivation and one-fourth is covered with forests. The agricultural soils are not all losing their fertility, but nine out of 10 counties are holding their own or gaining. The parts of the country which are losing are proportionately largest in Mississippi, Louisiana, Texas, Arkansas and Oklahoma. The soils are not, however, producing 50 per cent. of what they can and must produce in the near future, with population growing at the present rate.

The public land laws, according to the Commission, do not furnish the necessary protection to the public interest. All those resources which still belong to the Nation should be used in such a way as to prevent waste, the land being turned into private ownership only when most valuable for agricultural use. Losses to live stock, grain, etc., due to injurious mammals are estimated at $100,000,000 annually. Losses due to the ravages of insects are estimated at $650,000,000. Most of these losses are said to be preventable. The public range, estimated at 300,000,000 acres, is in very bad condition and can be put into a proper state only by rigid control on the part of the United States. Some 75,000,000 or 80,000,000 acres of swamp and overflowed lands can be added to the cultivable area by drainage and protection, thus increasing the value of the present lands from 100 to 200 per cent.

Water Resources

The Section of Waters finds that the quantity of rainfall annually is 215,000,000,000,000 cu.ft., of which over half is evaporated, about one-third flows into the sea, and the remaining sixth is either consumed or absorbed. Less than 5 per cent. is utilized for power and less than 5 for navigation. From 85 to 95 per cent. is wasted. The Commission estimates that the theoretical power of our streams is over 230,000,000 h.p., the amount now in use being 5,250,000 h.p. It is believed that 37,000,000 h.p. would be available at a cost comparable with that of steam installation, while the amount available at reasonable cost is from 75,000,000 to 150,000,000 h.p. The 37,000,000 h.p. exceeds the entire mechanical power now in use. Damage by floods is estimated at $238,000,000 per annum, there being great loss through erosion and flooding. The Commission recommends the system of waterway improvement already recommended by the President, including irrigation, power development, purification of streams, etc. The work is estimated to last 10 years at a cost of $50,000,000 annually, while the savings are alleged to be, on transportation $250,000,000, on flood damage $150,000,000, on forest fires $25,000,000, through cheapened power $75,000,000, through saving in soil erosion $500,000,000; or in all 20 times the cost of improvements.

Forest Resources

The Section of Forests reports that our present forests cover 550,000,000 acres. Of this forests publicly owned are one-fourth and forests privately owned three-fourths. Forestry is now practiced on 70 per cent. of the public and on less than 1 per cent. of the private area. The yearly growth of wood averages about 12 cu.ft. per acre, or 7,000,000,000 cu.ft. anually. About 23,000,000,000 cu.ft. are used each year, including 100,000,000 cords of firewood, 40,000,000,000 ft. of lumber, more than a billion posts, poles, fence rails, etc.

Forest fires have caused an average annual loss since 1870 of $50,000,000. About one-fourth of the standing timber is lost in logging and about one-third to two-thirds of the timber sawed is lost in the mill. Only 320 ft. of lumber are used for each 1000 ft. which stood in the forest. On the whole three and one-half times their yearly growth is taken annually from the forests, the lumber cut having increased less than 15 per cent. in the last seven years, while the average price at the mill has risen 49 per cent. Thus far lands successfully planted to trees make a total area smaller than Rhode Island, while we are sending out of the country annually 1½ times as much timber as we bring in. The Commission asserts that under right management our forests will yield four times as much as now, while forest fires can be stopped and waste in the woods and at the mill can be cut by one-third. The important task, according to the Commission, is to induce private forest owners and users of wood not to waste the supply. In general the methods recommended by the Commission are the stopping of forest fires; more careful logging; the use of preservative treatment for timber; the avoidance of needless loss in the mill, the factory and in use; the planting of treeless lands mostly likely to be useful under forest; the adjustment of taxation so that cut-over lands can be held for a second crop, and the improvement of the national forests.

Mineral Production of the French Colonies

SPECIAL CORRESPONDENCE

The French colonies—not including those in North Africa—are beginning to assume some importance as mineral producers. The total value of their mineral products increased from about $2,800,000 in 1900 to approximately $5,600,000 in 1906, doubling in value in five years. The colonies which report mineral production include French Guiana, the French Congo, West Africa, Madagascar, Indo-China and New Caledonia. The North African colonies—Algeria and Tunis—are under a different administrative régime, and their statistics are presented in a different form.

The total value of the mineral products of the six colonies above named in 1906 was as follows:

Guiana—gold	$1,825,759
New Caledonia—nickel, cobalt and chrome ore	1,331,851
Madagascar—gold and iron ore	1,275,674
Indo-China—gold, tin, zinc, wolframite, coal	898,911
French Congo—copper	86,850
West Africa—gold	10,420
Total	$5,429,465

The total quantities and values of the different mineral products are given in the following table; the figures are metric tons, except gold, which is in kilograms:

	Quantity.	Value.
Gold, kg	5,768	$3,128,914
Nickel ore, tons	118,890	504,809
Cobalt ore	2,628	71,020
Copper ore	1,500	86,850
Tin ore	24	12,159
Zinc	2,061	118,695
Iron	13	12,086
Chrome ore	84,281	756,021
Coal	296,420	697,512
Lignite	19,149	41,399
Total value		$5,429,465

Gold is obtained from placer workings in West Africa, Madagascar and Guiana; also by dredging in Guiana. The production of Guiana was 3503 kg.; of Madagascar 2200 kg.; the balance coming from West Africa.

Nickel ore comes entirely from New Caledonia. The Société le Nickel, controlled by the Rothschild house in Paris, is the principal operator in that colony. Its relations with the International Nickel Company assure its control of the European market. Cobalt, which is also produced in New Caledonia, is suffering from over-production and accumulation of stocks; at present most of the mines are closed. This situation is due chiefly to the large recent production in Canada.

The chrome ore comes from New Caledonia, where there were six concessions worked in 1906. The most important of these is the Tiebaghi mine in the north of the island, which is owned by the Société le Chrome, but is worked on royalty by Birch & Co., Ltd., of London.

Coal and lignite are mined in Indo-China. The principal operator is the Société Française des Charbonnages du Tonkin, which works the mines of Hongay on the bay of Along.

Some important mineral deposits are as yet little worked. These include copper in the French Congo and in New Caledonia; zinc and tin in Indo-China, where important installations are projected. These justify the hope of an important increase of production in the French colonies.

A Long Rest for a Blast Furnace

Various causes, including strikes, revolutionary troubles and a short supply of coke, made it necessary last year to cease operating the blast furnaces of the Hantke Company, at Czenstochau, in Russian Poland. To avoid the inconvenience and possible danger of blowing out the stack, it was decided to bank the furnace. The stack had a capacity of 140 tons a day; at that time it had been in use over five years, and during that time it had been stopped once for repairs, and once had been banked for 28 days.

As soon as the blast had been stopped, the tuyeres were all hermetically sealed, and the furnace received charges of five tons of coke, five tons of ore, five tons of coke again; eight ordinary charges and finally several charges with an excess of coke. On top of the last charge there was placed a layer of granulated slag, then a layer of clayey iron ore, and finally one of clay, the latter reaching to the mouth of the stack. The outside was coated with coal tar, to prevent leakage of air through cracks in the masonry, and was left to itself. At the end of five months an examination showed that the tar coating had begun to crack in places; consequently some air had made its way through the joints of the brickwork, and the level of the contents of the furnace had begun to lower slowly.

According to *Stahl und Eisen*, nothing further was done for nine months, when it was decided to put the stack in blast, just 14 months after it had been closed. The first step was to open the discharges for slag and iron; then to charge coke and ore at the top, the first charges having an excess of coke, which was gradually diminished to a normal proportion. The tuyeres were then reopened and the blast put on gradually, care being taken to allow the slag to run off freely. At the end of 36 hours the iron began to run, and in a few days the furnace was making its normal production, and working freely.

Size of Lake Ore Carriers

The increase in the size of vessels carrying iron ore on the Lakes is strikingly shown in the following table, compiled by the *Marine Review* from the records of the Lake Superior & Ishpeming dock at Marquette. The figures give the number of vessels loaded each season, with the average cargo, in tons:

	Vessels.	Average Cargo.		Vessels.	Average Cargo.
1898..	488	2,223	1903..	353	3,112
1899..	563	2,431	1904..	276	3,668
1900..	524	2,661	1905..	460	4,197
1901..	511	2,991	1906..	371	4,628
1902..	446	3,109	1907..	331	5,107

This year to Nov. 1, only 112 vessels have been cleared and the average cargo was 6646 tons. This high average is due to the fact that only the larger boats, belonging to the steel companies, have been in commission this year. Very few of the small wildcat boats have done anything, owing to the light shipments.

British Guiana Mines

Exports of gold from British Guiana for the 10 months to the end of October were 55,282 oz. bullion in 1907, and 55,101 oz. in 1908; a decrease of 181 oz. The bullion reported this year was equal to $975,734, or 45,270 oz. fine gold.

Exports of diamonds this year were 3821 carats, valued at $30,078; an increase of 1780 carats and $13,695 in value over last year.

Main haulage drifts should be well drained.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Edmund B. Kirby, consulting mining engineer, St. Louis, Mo., has been visiting New York.

Arthur Thacher, mining engineer, St. Louis, Mo., has been visiting New York and Boston.

Cyrus Robinson, consulting engineer, New York, sailed for Europe Dec. 9, expecting to be abroad about two months.

Charles H. Fulton, president of the South Dakota School of Mines, Rapid City, S. D., has been visiting New York.

John E. Hardman recently returned to Montreal after a prolonged absence on business for the Canada Iron Corporation

William J. Cox, general manager of Camp Bird, Ltd., Ouray, Colo., has been called to London on business connected with the company.

John A. Church, mining engineer, of New York, has gone to the West on professional business, expecting to be absent about three weeks.

H. C. Eastman, a well known operator in Gilpin county, Colo., was seriously injured in a railroad accident near Pittsburg, Penn., on Nov. 30 last.

R. K. Hamilton, of McKeesport, Penn., has been appointed superintendent of the coal mines at Sutterville, Penn., owned by the Oak Grove Coal Company.

William S. Mann, manager of the Boston & Oaxaca Mining Company, has returned to Tlacolulu, Oaxaca, Mexico, from a trip to the United States.

Walter Fitch, who recently resigned his position with the Calumet & Hecla Company, is in Salt Lake City, Utah, where he proposes to stay for some time.

Marshall D. Draper has been appointed general manager of the Fifty Consolidated Gold Mines Corporation, operating at Black Hawk, Gilpin county, Colorado.

H. B. Clarkson, late of Eleno, W. Va., has been appointed manager of the Turkey Knob Coal Company, at Macdonald, W. Va., and has taken charge of the mine.

Robert G. Wells, general manager of the Tata Iron and Steel Company, of Bombay, who has been visiting this country, sailed from New York Dec. 2, on his return to India.

E. J. Franz, of New York, consulting engineer, who has been directing the development of mines in Plumas county, Cal., for Eastern owners, was in San Francisco last week.

A. P. Scott, for some time past chief chemist for the Dominion Iron and Steel Company, has been appointed chief metallurgist to the General Electric Company, with headquarters at Schenectady, New York.

J. Gordon Hardy, recently of El Paso, Texas, and formerly manager of the Dolores Mines Company, has been appointed consulting engineer in charge of La Republica Mining Company in Chihuahua, Mexico.

Frederick Keffer, of Greenwood, B. C., consulting engineer of the British Columbia Copper Company, recently made a thorough examination of the Brooklyn and Rawhide mines of the Dominion Copper Company.

John P. Cosgro, mechanical superintendent of the American Smelters Securities Company of New York, has tendered his resignation to take effect Jan. 1, 1909. Mr. Cosgro is at present at the Flat River plant of the Federal Lead Company.

E. C. Felton, president of the Pennsylvania Steel Company, has gone to Cuba to inspect the iron mines controlled by the company there. He is accompanied by John W. Dougherty, Quincy Bent and Charles F. Rand, officers of the company.

Samuel Treloar has been appointed manager of the mines of the Bingham-Butte Consolidated Mining Company at Bingham, Utah. He has been a resident of Butte, Mon., for 20 years past, and has held important positions with several mining companies there.

Thomas L. Lewis, president of the United Mine Workers of America, has been appointed by President Roosevelt a member of the National Advisory Board, which is directing the investigation into coal-mining conditions and means for the prevention of accidents.

E. C. Trask, general foreman of the Yampa Smelter, Utah, and Edward L. Kraemer, chemist at the same plant for the past 3½ years, resigned Dec. 1, to engage in the coal business at Salt Lake City, Utah. The name of the concern is the Wasatch Supply Company.

Obituary

General Sir Henry Wilkinson died at Kenora, Ont., on Nov. 23, aged 69 years, after a short illness. General Wilkinson had a distinguished military career, having entered the British army in 1856. For some years past he was prominent in the mining affairs of the Lake of the Woods district, Ontario, and was managing director and the principal shareholder of the Black Eagle gold mine, near Kenora.

Thatcher Tucker Bent, who died in Oglesby, Ill., Nov. 28, was born in Massachusetts in 1833, and went West in 1853. After working as a civil engineer for 12 years, chiefly on railroad work, he settled in Oglesby in 1867 and took charge of a coal mine there. Later he took part in the organization of the Oglesby Coal Company, subsequently becoming the chief owner. He was the oldest coal operator in Illinois.

Edwin H. Jones, who died at Wilkes-Barre, Penn., Dec. 2, aged 64 years, was well known throughout the anthracite country. As a young man he began work in the Vulcan Iron Works, at Wilkes-Barre, which were founded by his father in 1863. He became familiar with the construction of mining machinery, and when his father died he succeeded him as president, a position which he held up to the time of his death.

Addison J. Lysle, who died at Los Angeles, Cal., Nov. 29, was for many years one of the best known river coalmen in the Pittsburg district, and a prominent member of the Pittsburg Coal Exchange He was a member of his father's firm, George Lysle & Sons, and later treasurer of the Lysle Coal Company until the latter company sold out to the Monongahela River Consolidated Coal and Coke Company; besides having other important coal-mining and river interests. In 1900 he removed to California, and had since resided there the greater part of the time.

Enoch James, who died at Cardiff, Wales, Nov. 13, aged 60 years, had been manager of several important iron works, his most notable service having been with the great Dowlais works, near Cardiff, which were reconstructed under his charge. Since 1902 he had been employed as consulting engineer, his services being in much request. He was regarded as a high authority on iron and steel. In 1901 he was a member of the commission sent by the British Iron Trade Association to inquire into the iron and steel industries of the United States, and he contributed largely to the report made by that commission. He was a member of the Iron and Steel Institute and of several other technical societies.

Societies and Technical Schools

Mining and Metallurgical Society—The New York section will meet at the Engineers' Club, Thursday, Dec. 17. The Philadelphia and San Francisco sections will meet at about the same time.

Canadian Mining Institute, Toronto Branch—At a meeting held in Toronto, Nov. 19, resolutions were passed urging the retention of Hon. William Templeman as minister in charge of the Dominion Department of Mines. After the meeting a dinner was given to H. E. T. Haultain in honor of his appointment as professor of mining and metallurgy in the University of Toronto.

Pioneer City Mining Institute—This association was organized at Carbondale, Penn., Dec. 3, where the following officers were elected for one year: President, Mining Inspector P. J. Moore; secretary, D. R. Morgan; treasurer, J. C. Patten. The object of the association is to bring operators and employees together for the discussion of practical mining questions, in the same way as is now done by the Scranton and other local institutes.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Denver, Butte, Goldfield, Wallace and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

Dec. 4—The Trinity River Mining Company has less than 300 ft. to run to complete its tunnel across the bend of the river above Lewiston. It will be eventually 10x12 ft., large enough to carry all the water of the river. The water will be run to low-pressure turbines to furnish power for mining purposes. About a mile of the river bed will be laid bare when the water is turned into the tunnel, and this will then be mined.

In addition to the suction dredge being built at Hamburg Bar in Siskiyou county, other gold-dredging operations in that county are pending. A. W. Graham is prospecting the Wood Rat Bar and the Quigley ranch on the Klamath river, and Mr. Wade, of Callahan, has bonded the Lowden ranch at Seiad for dredging purposes. He is also prospecting the Collins ranch below Oak Bar and has bonded the Bailey place adjoining. The possibilities of the Klamath river as a dredging field are being well tested this year.

Hydraulic mining men in Nevada county have laid claim to the lands on which the noted Indian "campoodie," of Nevada City, is located, alleging them to be gold-bearing. The matter has been carried to the United States Land Office, and testimony is being taken. Meantime local men are organizing a strong opposition to the attempt to oust the Indians. Aid will be given them in protecting themselves from the mining claimants of the land. The campoodie is a picturesque Indian village, occupied as long as the white inhabitants have knowledge of the ground.

In this connection it may be stated that the superintendent of the Government Indian school at Carson, Nev., is about to establish an employment office for the purpose of supplying farming and mining labor for Nevada. No fees will be charged.

H. G. A. Brunnier has secured money to pay off the debts of the Conlin mine, in Nevada county. Some of the old employees have already received checks, and the information comes that all debts will be paid and the mine will be suitably developed. The company has been in financial difficulty for over a year.

A new company has been organized in this city which is of interest to dredging men. This is the Natoma Consolidated Companies of California, with a capital stock of $25,000,000. In this consolidation are the Feather River Development Company, the Natoma Development Company, the Folsom Development Company and several others. W. P. Hammon is to be the general manager. New dredges will be built and additions made to the machine shops and repair plants already owned by the companies. Considerable power will be developed, not only for the company's own use but also for cities and towns in the Sacramento valley. Among other things an electric railroad will be built from Folsom to Sacramento and a large tract of land will be reclaimed and sold in lots. The company will not only build and work dredges but will work stone quarries, construct reservoirs, handle gravel and cement and supply water, electricity and gas. Road metal will also be made extensively, the rock piles thrown up by the dredges being used for this purpose. It is also proposed to open new dredge fields. The Natoma and Folsom Development companies are the largest operating in the Folsom field, W. P. Hammon being the manager of one and R. G. Hanford of the other, and they have in operation between them nine dredges, all of large size. The Feather River Development Company at Oroville, another of the Hammon companies, owns four dredges. These companies have acquired large areas of dredging land which they are mining, and intend to obtain more.

The company which has started gold-dredging operations near Snelling, Merced county, has been so far apparently successful and this has drawn the attention of others to the valley of the Merced river as a mining or dredging field. The place is some seven miles below the foothills and it is now supposed that there must be an old gravel channel in these foothills from which the gold lower down came. Some prospecting operations are now going on in the attempt to find this supposed channel. Prospecting work is also being carried on by an Oroville dredging company on the Robinson farm, three miles above Snelling, on the south side of the river, and another ranch lying just below is also to be tested with drills. The field is a new one and thus far very little work has been done.

Goldfield, Nevada

Dec. 5—Goldfield is trying hard to get the business of the new town of Helena, built near the Broken Hills mine in the Clifford district. The route to the mine via Tonopah is 76 miles long, while the road from Goldfield is 22 miles shorter. This road is at present in bad condition, but private citizens intend to improve it so as to divert trade to Goldfield. Goldfield has applied for a postal service from Goldfield to Clifford, but this application has been protested by Tonopah. Helena is 9 miles from Bellehelen, 7 miles from Golden Arrow, and 12 miles from Silver Bow, all in a southeasterly direction. This district is a most promising one.

On the other side of the Montezuma mountains 23 miles west of Goldfield near where the road to Silver Peak descends into Salt Marsh oil is being prospected for. It is thought that oil would be found before a depth of 1000 ft. is reached. Last week at a depth of 250 ft. a body of natural gas was tapped which blew the drilling rig into the air, demolishing it; several men narrowly escaped being killed by this accident.

It is said that material has been ordered by the Nevada California Power Company for extending its electric light and power service to the camps of Manhattan, Round Mountain, Rawhide and Fairview. Goldfield, Tonopah and Bullfrog are already supplied.

An interesting feature of the development of the Goldfield district is the work being done in the outskirts. The Ben Hur 3½ miles and the Nevada Eagles 3 miles west of town are both doing considerable prospecting. This western portion has never been prospected heretofore. This area is capped by "malapai" and has been the scene of one or two of the worst wildcat promotions in the history of Goldfield. The Eagles company has opened up ore by sinking on a porphyry outcrop which is visible for only a short distance. The geology of the portion of the camp is not very well known but if the Eagles company's ore proves to be abundant as the management believes from present indications a great impetus will be given to prospect the western section now disdained on account of the "malapai" capping. Three miles east of town the Goldfield Fissure company has done some promising development work and farther east the Buzzard company is prospecting its ground. In the Red Mountain district, 8 miles to the northeast, some work is being done, while in the Diamondfield district, 4 miles north and east of Goldfield, desultory mining is being done owing to the fact that the policy of the Daisy company, which conducts its work very secretly, has handicapped the whole district by throwing discredit on that part of the Goldfield district.

Though plans have not yet freely matured a merger of the properties of the Columbia Mountain, the Oro, the Booth

and the Nighthawk companies in under way, but no details are available. George Wingfield is one of the heaviest owners in these companies.

The leasers of Goldfield have organized into a society for promoting the general welfare of leasers and the leasing industry, which has made Goldfield. Officers were elected and many grievances were discussed, but no definite action was taken at the first meeting.

There has been another sale of sulphur ground at Cuprite (which name is proving to be a misnomer) 17 miles south of Goldfield. The original property is shipping sulphur of various grades up to 98 per cent. sulphur for prices ranging up to $15 per ton f.o.b. mine. This second company, controlled by Ellsworth Oldt who negotiated the first sulphur deal, will hasten the opening-up of its property. Negotiations are under way for a sulphur smelting and refining plant. The sulphur at Cuprite is said to contain some gold and cinnabar.

Butte

Dec. 3—On Nov. 30 Samuel McConnell, trustee of the bankrupt Butte Central & Boston Copper Corporation, sold at public auction the Ophir claim, subject to the various attachment liens now on the property. The successful bid for the property was $7500, and was made by Walter S. Tallant, representing the local creditors of the company. Freeman I. Davidson, of Boston, a director of the bankrupt corporation, was in Butte for a week before the sale making arrangements for the satisfactory settlement of the company's affairs. As a result of his work there is now complete harmony among the creditors. Mr. Davidson states that a new corporation will be formed in Boston for the purpose of operating the mine, and he expects to put it on a producing basis within a short time.

The early part of this week a party of Montana smeltermen left for Salt Lake City to open offices preparatory to the construction of the new smelter in Tooele county, Utah, under the terms of the agreement between W. D. Thornton, of Butte, and the Utah Consolidated Copper Company. C. H. Repath, construction engineer of the Washoe smelter at Anaconda, will be in charge of the work. With him are J. B. McIntosh, of the engineering department of the Washoe smelter, who will direct the field work, and J. B. Whitehill, of the Anaconda Copper Mining Company's purchasing department, who will attend to the buying of the materials. The undertaking of this work by men so closely connected with Amalgamated interests in Butte is regarded as an indication that the Amalgamated is preparing to enter the field which has for some time been dominated by the American Smelting and Refining Company.

In the action of W. W. Wishon against Miles Finlen for alleged breach of a contract regarding the Minnie Healy mine, the district court has rendered a decision for the plaintiff for $1 damages. The suit was brought because of the alleged failure of Finlen to pay Wishon $7142 when Finlen purchased the Minnie Healy. Under the decision of the court it was found that Finlen had never in fact purchased the mine, and was, therefore, never bound to pay the money to Wishon.

The report of the United States assay office in Helena for last month shows that Madison county is the leading gold producer in the State with an output of $51,031.88 for the month. Fergus county is second and Lewis & Clark county third. The total receipts of Montana gold for the past month amounted to $102,518.

The affairs of the North Butte Extension Copper Mining Company are still before the Federal district court. Two days ago, the objections of the Ingersoll-Rand company and the United States Fidelity and Guaranty Company having been withdrawn, the bankruptcy proceedings against the mining company were dismissed. Immediately thereafter the National Mining and Investment Company, of Butte, filed a petition asking that the North Butte Extension Company be placed in the hands of a receiver. In the petition for the appointment of a receiver it is alleged that there has been an overissue of stock by the corporation, that there has been mismanagement of the company's affairs, and that the company is preparing to turn over all of its property to the North Butte Extension Copper Development Company, a corporation organized to get control of the property. While the matter is pending, word has been received from the committee on reorganization that they have granted another extension of time in which stockholders may make their assessment payments.

Denver

Dec. 5—The Western Metals Company, of Denver, has been incorporated with a capital stock of $1,000,000, its object and purpose being, it is said, to build a plant where the most refractory ores may be treated by what is termed an electro-chemical process, which eliminates both concentration and smelting, and is specially adapted to the recovery of zinc. This is a large order, and we shall look with anxiety for more detailed information.

In Leadville, Mrs. Tabor has been enjoined from operating the Matchless mine, which, it appears, she tried to superintend herself and to interfere with the lessee.

The advance of $1 per unit in the price of tungsten ore, resulting from the renewed activity in steel manufacturing centers, is having immediate effect in the Boulder county tungsten belt, where mines are being reopened, idle mills put in commission again, and general activity everywhere shown. A prosperous winter in these mines is confidently anticipated.

London

Nov. 28—The annual general meeting of the Consolidated Goldfields of South Africa Ltd., was held on Nov. 17, the chairman of the company, Lord Harris, presiding. In reviewing the events of the year the chairman was able to report a great improvement in the industrial position. The principal mines, which are under the management of the company and in which it has large holdings, namely the Simmer & Jack, the Robinson Deep and the Knights Deep, have made a large increase in profits, due to increased production, and to reductions in working costs. The obligations of the company to the managers and technical staff were not forgotten and the chairman made a graceful reference to the good work done by the officials in South Africa who, in consequence of the change over on many mines from Chinese to Kafir laborers, have had this year a particularly difficult task to perform.

As regards the future the chairman spoke in an optimistic vein, saying that he saw no threatening factor to obstruct progress. If there was any cloud on the horizon, it was in connection with unskilled labor, the supply of which might not meet the demands that would be made owing to the all-round expansion of business. This year will see the termination of the employment of Chinese on the mines. Their places have been filled by Kafirs, who have been recruited in larger numbers than formerly. Whether this supply will be maintained or not is the doubtful question, but Lord Harris anticipates that any difficulties that may arise in keeping the mines working, owing to insufficient unskilled labor, will be surmounted. In what way the deficiency of unskilled labor would be met was not explained, but it may be assumed that it will be brought about partly by increased economy in its employment and partly by a more extended use of mechanical appliances. The view taken by Lord Harris as regards labor is supported by Lionel Phillips, president of the Transvaal Chamber of Mines, who in an address to the Chamber on Nov. 19, is reported to have said that he conscientiously believed that with united action and with the benevolent assistance from the governments of South Africa, and with the probable assistance of mechanical appliances, they would meet the growing requirements of the industry. He further said that he would not be surprised if the output were to rise to £4,000,000 or more per annum. The Goldfields shareholders were also addressed by Drummond Chaplin, one of the joint managers in South Africa, who also spoke hopefully of the future prospects of the mining industry, saying, that during the eight years that he had held his position, he had never seen the sky so clear as it is at the present time.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

KETCHIKAN DISTRICT

It Mining Company—This company has shipped since Oct. 15 a total of 1200 tons of gold-copper ore to the Tyee smelter at Ladysmith, British Columbia.

Arizona

COCHISE COUNTY

Copper Queen—The smelter is operating eight blast furnaces, one reverberatory and six converter stands. The output for November is expected to be about 8,500,000 lb. copper.

Calumet & Arizona—Five furnaces are in operation, one of 500-ton capacity, and four of 300 tons. It is the intention to enlarge all the original furnaces, preparation for the work being under way.

GILA COUNTY

Arizona-Michigan Copper Company—This company has been found in Calumet, Mich. The property consists of 670 acres in the mineral belt of the Globe district, Arizona, and it is believed to carry the extension of the Old Dominion lodes and the Black Hawk vein of the Arizona Commercial Company. The company is capitalized at 150,000 shares of $10 each. James Chynoweth is president, Silas Chynoweth, secretary and W. B. Anderson, treasurer.

Old Dominion—Four furnaces of the smelter are in commission, and the total output for the year is expected to reach 3,500,000 lb. of copper. The November production was about the same as that of October.

Montgomery—The Warrior Copper Company is developing in this mine an orebody running high in copper. It has been opened on the 250-ft. level by a drift 450 ft. long and a crosscut of 65 feet.

YAVAPAI COUNTY

Alvarado Mining Company—This company, Congress Junction, is putting in a 25-stamp mill, and fitting up for direct cyaniding. Tube mill regrinding will be used, and only bullion will be shipped. The property is developed to the 1700-ft. level, and has enough ore blocked out to run the mill two years. The old Yarnell mine which is being operated by leasers is said to be on a continuation of the same vein.

Golden Ridge Mining and Milling Company—This company has been organized, with Byron Smith, of Congress Junction, as the superintendent. It has taken over a group of claims west of the Congress mine, and adjoining the Ohio group. The ledge outcrops for a width of 9 ft. The shaft is about 75 ft. deep. This company has also purchased three claims adjoining the Alvarado mine, and will put a force of men at work there at once. Two separate camps will be maintained as the two properties are about eight miles apart.

United Mines Company—This company, of Congress, under the management of D. J. Sullivan, is installing a cyanide plant. The mine is down about 500 feet.

Ohio Group—It is understood that work will be again resumed on this group adjoining the Golden Ridge. A shaft has reached a depth of 200 ft. and has considerable water, which will soon necessitate the installation of other machinery.

Arizona Gold Company—O. L. Geer, of Congress Junction, manager of this property, about 25 miles west of Congress Junction, states that the company will install machinery during the first part of the year, and force sinking. The mine will need a hoisting plant.

Venus Mining Company—This company is planning to begin operations. E. H. Hagy, of Rapid City, S. D., president, will probably be on the ground by Dec. 1. The shaft on the property 10 miles west of Congress Junction is down 125 ft., and a hoist will be installed.

Octave—This company is changing its entire plant over to use electric power, which is to be furnished by the Central Arizona Power Company, of Wickenburg, Ariz. It is understood that this power company is a subsidiary organization of the Octave, though it purposes to sell power to any and all consumers who are within easy reach of its transmission lines.

California

AMADOR COUNTY

Volcano Ditch—A new inverted siphon has been installed, flumes repaired and ditch cleaned out, so that the ditch is now in as good condition as when built about 50 years ago.

BUTTE COUNTY

Blue Channel Gold Mining Company—This company recently bought the old Durgin claim near Paradise. An upper stratum of gravel was recently found by Superintendent E. D. Casterline. The Gunn, on the same channel, is also being opened.

CALAVERAS COUNTY

Easzy Bird—This mine in Mokelumne river district, J. B. Sauve, superintendent, is showing a rich shoot of ore. A three-drill Burleigh compressor has been installed, and five stamps are being added to the mill.

Kenross—At this property, near Whisky Slide, S. W. Kerley, superintendent, a storage reservoir has been built, the ditch repaired, and a débris dam for tailings will be constructed.

EL DORADO COUNTY

Capitola—At this mine, owned by Salt Lake men near El Dorado, J. P. Cowan, superintendent, a 10-stamp mill is being installed and also a new steam hoist.

Union—At this mine near El Dorado a new hoist has been installed and also new hydraulic pipe. Considerable timber has also been hauled in for timbering. M. L. Efflinger, of Nevada, is directing affairs, so it is supposed that the mine has changed hands or management..

INYO COUNTY

Keane Wonder—A 200-ton cyanide mill is to be erected at this mine to treat the 14,000 tons of tailings on hand. There is a 20-stamp mill on the property.

Silver-lead Ores—The Christmas Gift mine at Darwin is shipping silver-lead ore to the smelter at Keeler, and the Lucky Jim operated by Charles Fitzhugh is doing the same. The Flier, north of Darwin, is preparing to make shipments to the smelter.

X-Ray—Williams Brothers are developing this group in Redding cañon, two miles south of the Dunlop. A tunnel has been put under the old workings, in the face of which is an 18-in. vein carrying good values in free gold.

MARIPOSA COUNTY

Mount Ophir—This old mine, near Mt. Bullion has been leased by Sane & Furey, who will work it this winter, shipping the ore to the mill at Bagby.

NEVADA COUNTY

Pennsylvania—A ledge 30 in. wide has been met on the 1400 level of this mine and some specimen ore is being taken out. This mine was formerly a dividend payer but for a long time has had a run of hard luck.

PLUMAS COUNTY

North California Mining Company—Douglas Waterman, a mining engineer in the employ of this company, is prospecting

in American valley, testing the ground for a possible dredging proposition.

SIERRA COUNTY

No Better—At this mine, Forest district, a new gasolene hoist has been put in and a new gallows frame erected. A three-compartment shaft is being sunk.

SONOMA COUNTY

Great Eastern Quicksilver Mine—This old mine near Guerneville ceased operations a few months ago, but there has been a large amount of quicksilver cleaned up from where it had accumulated about the furnaces in the past 20 years.

TRINITY COUNTY

Collins—This mine in Spring gulch has been equipped and its cannon-ball mill is to be set running as soon as there is a water supply.

TUOLUMNE COUNTY

Tuolumne River Water Power Company—This company has acquired the Golden Rock ditch and water rights of the Big Creek Ditch Company. The ditch runs from the middle fork of the Tuolumne river to a dam on the south fork and thence to Garotte, Big Oak Flat, to a dam on Pina Blanca creek.

YUBA COUNTY

Blue Point—The reservoir for holding the water for this mine has been completed and work will be resumed on the ditch when E. W. Tarr, the superintendent, returns from the East. The machinery for digging the ditch has all been shipped and the ditch line will be finished in two months.

Colorado

BOULDER COUNTY

Cashier Mill—It is reported that this mill at Camp Albion is to be increased from a 25-ton to a 75-ton daily capacity. Thomas Wood, Boulder, Colo., is manager.

Primos Mining and Milling Company—Two carloads of tungsten concentrates were shipped recently to the Primos Chemical Company, at Primos, Penn., the value of the shipment being $12,000 and representing a 40-days' run at the mill near Cardinal.

CLEAR CREEK COUNTY

Georgetown Mining, Power and Transportation Tunnel Company—This company, organized in the Georgetown district to build a 16,000-ft. tunnel into Columbia, Democrat and Sherman mountains, is contracting with the American Rotary Tunnel Machine Company, owning the Sigafoos drill, to install one of its machines. Part of the conditions were that two weeks are to be allowed for installation, and two weeks in which to prove the efficacy of the machine.

Terrible-Dunderberg—It is reported that this silver mine, in the Georgetown district, which has been idle for many years, is to resume operations. The Terrible is credited with an output of $10,000,000 in all.

GILPIN COUNTY

Fifty Consolidated Gold Mines Corporation—The Fisk vein has been opened up at a depth of 1400 ft., and is 5 ft. in width, all free milling ores. The company proposes to sink its 1450-ft. Cook shaft a further depth of 1000 ft. and develop on a heavy scale, and will arrange for the installation of a large pumping plant. M. D. Draper, Central City, Colo., is manager.

Golden Sun—Eastern and Colorado men are interested in property on South Boulder creek near Rollinsville, and they propose the installation of an air-compressor plant as well as electrical equipment of their property. E. T. Butler, Kittredge building, Denver, Colo., is manager.

Lucania Tunnel and Mines Company—Articles of incorporation showing capital stock of $2,500,000 have been filed, with E. A. Colburn, W. M. Kirby and J. A. Wright, of Colorado Springs, Colo., as incorporators. The company will operate in Gilpin and Clear Creek counties.

LAKE COUNTY

Lilian—John Withey is leasing on the lower portion of this property, Iowa gulch, and for some time has been working in ore. A few days ago a body of sand was opened in one of the drifts, and when it ceased to run the whole roof of the drift showed some native gold. Withey at once examined the pile of sand and found that it contained quantities of the yellow metal; he took samples from the pile and assays gave high returns. Since the opening of the sand work has shown that the pocket is of considerable length and hight. Being practically placer mine, Withey will run the whole of the sand through boxes.

North Mike—David Holden and associates have secured a lease on this property, Iron Hill, and are now engaged in opening the orebody in the upper workings; the ore is a good grade of iron containing considerable silver. The lower workings of the property have been cut by the Yak tunel, and when the upper workings are cleaned out of ore, the lower part will be worked from the tunnel level.

Tenderfoot—Several practical miners have secured a lease on this property, South Evans gulch, and will start at once to sink a new shaft. The property adjoins the Favorite, from which steady shipments of good ore are being made. It is expected that the new shaft on the Tenderfoot will require to be sunk over 150 ft. before the ore is reached.

OURAY COUNTY

Camp Bird, Ltd.—During October the mill ran 30 days, crushing 7054 tons, dry weight, and yielding 8329 oz. bullion and 441 tons concentrates. Sales of bullion and concentrates were $182,393; expenses at mine $49,082, and in London $1500, leaving a profit of $131,811. Expenditures for new construction were $178. There were 363 ft. of new development done.

Mono-Baltic—This company writes as follows of its mines at Ironton: "The company's claims now aggregate 180 acres, and development work has been so well pushed forward in the past 12 months, that there is fully 120,000 tons of ore in sight. The mines contain not only clean sulphide and silicious ores, but carry plenty of lime as well, making a healthy smelting proposition. The ores average 3.5 per cent. copper and 12 oz. silver per ton. The company has shipped 400 tons, mostly to the American Smelting and Refining Company, at Durango, averaging 7 per cent. copper and 14 oz. silver per ton. The grading for the smelter is now finished, and the company expects to have a 200-ton furnace installed in the spring."

PROWERS COUNTY

Lamar Oil and Gas Company—This company has struck what appears to be a body of oil in its new well at Lamar, at a depth of 1535 ft. The well is now being cased and the water drawn out.

TELLER COUNTY—CRIPPLE CREEK

The face of the Roosevelt deep-drainage tunnel was in 4171 ft. at the end of November. In the Cripple Creek district, the November production is stated to have been $1,318,000 gross bullion value.

The second annual banquet given by the Golden Cycle Mining Company to the ore shippers of the Cripple Creek district, took place Dec. 5 at the National hotel.

Jo. Dandy—Another Cripple Creek mining plant has been burned down, that of the Jo Dandy, on Raven Hill, the mill buildings and shaft house being destroyed, the cost of which was said to be about $100,000, with $40,000 insurance. This is the fourth big fire of a similar nature within a few months.

Tax Reduction—The various Cripple Creek mining companies some time ago brought action against the board of county commissioners, county treasurer and county assessor of Teller county, for a reduction of taxes, on the ground that non-producing property, though adjoining ground that was richly productive, could not be assessed as high as the latter, and they won their suits in the district court. An appeal was taken to the Supreme Court, and pending a decision, the companies will pay their taxes under protest, a stipulation having been filed to that effect.

Idaho

IDAHO COUNTY

Mackay—A contract has been let for 100 ft. of development work. The claims were bonded by Fred Bradley while he was in central Idaho during the autumn.

Iron Crown—M. V. Garret, of Spokane, is at Newsome, preparing to start the stamp mill. Mr. Garret recently bonded the property upon which a small amount of development has been done.

Mount Marshall—Drifting is now being pushed on the 500-ft. level, where a crew of 25 men is employed. Supplies have been taken over from Stites sufficient to run through the winter.

SHOSHONE COUNTY

Full Moon—A compressor and drills are being installed at the mine, and as soon as completed, work will be started.

Blue Bell—William Carlson has taken a contract for 200 ft. of work. A contract for 400 ft.. has just been completed, making 1300 ft. of work on the property.

National Mining Company—A contract has been let for 100 ft. of shaft, which will give a total depth of 370 ft. The property lies north of Mullan.

Snow Cliff Mining Company—A contract for 100 ft. of work has been let. The property lies near the Liberty group upon which copper was struck a few weeks ago. Buildings are now under construction, and supplies are being laid in that work may be pushed all winter.

Cliff Creek Company—A vein of copper ore, 75 ft. wide and carrying 12 in. of solid chalcopyrite, has been opened up in the grading for the roadbed of the Chicago, Milwaukee & St. Paul railroad. A contract for 200 ft. of drifting has just been let.

Ruby Group—A strike of copper ore has been made on this group of claims, in the Lookout district. The group consists of four claims through which the ledge has been traced for 3000 feet.

Josephine Group—Two feet of ore carrying bornite and gold have just been opened up. The ledge is 12 ft. in width and in addition to the ore referred to carries a large quantity of good milling ore. A hoist and other machinery will be ordered and installed at once.

Paragon Company—A certificate of amendment to the articles of incorporation of this company has been placed on file with the county recorder by which the name of the company has been changed from the Paragon Mining and Manufacturing Company to the Paragon Consolidated Mining Company.

Hypotheek Company—At a recent meeting of the directors it was decided to order a new hoist with a capacity of 1000 ft., and also to have the company's claims patented. The hoist in use at present has a capacity of only 600 ft. The property is operated by the Western Investment Company, of Wallace.

Indiana

DAVIESS COUNTY

Washington-Wheatland Coal Company—This company, which operates a mine at Wheatland, is sinking a shaft to the third vein, which will be the deepest mine in this section of the country. The shaft will be sunk to a depth of 270 ft., at which there is a vein of coal 6 ft. thick, with a good top. The company has for several years been operating the second vein, but the quality of this coal is not as good as in the third vein.

GIBSON COUNTY

Winslow—This coal mine, near Oakland City, began operation Dec. 7. This mine, one of the largest in this field, has been closed for several years, and was allowed to fill with water. This has been pumped out and the mine thoroughly repaired. A new railroad switch has been completed. W. W. Wulfman, formerly operator of the Hartwell mines, is in charge of the work.

KNOX COUNTY

Peacock Coal and Mining Company—The stockyard at Massey caught fire from spontaneous combustion Dec. 1, and the fire has not yet been extinguished. The pile of coal has been cut in two, isolating the burning portion. About 500 tons will be lost.

VERMILION COUNTY

Plans for sinking a new coal mine just west of Fair View, a recently incorporated town two miles north of Clinton, have been announced by T. A. Kibby. Chicago coal operators are back of the enterprise, having secured options on 1000 acres of coal land.

Louisiana

Oil production in Louisiana in November is reported at 433,100 bbl., an increase of 19,000 bbl., as compared with October. Shipments reported by rail were 206,073 bbl.; by pipe line, 161,000; total, 367,073 bbl. This does not include oil delivered to local refineries or used in the field. There were 14 new wells completed in the Louisiana field during the month, of which eight were oil producers, one a gas producer and five dry holes. There were 43 wells in progress at the end of the month.

Michigan

COPPER

Ahmeek—Work on the new stamp mill that this company is erecting is progressing favorably; the foundations for the wash are about completed and will soon be ready to receive the structural steel.

Franklin—The footwall of the Pewabic lode has been reached in the crosscut from the the 24th level. The lode opened at the 23rd level was well mineralized.

Centennial—At the stamp mill, which is owned jointly by this company and the Allouez company, the erection of the two additional heads is progressing nicely; the concrete foundations are ready and the large anchoring castings are in position. This will give the mill five heads, four steeple-compound and a single cylinder, which will be remodeled as soon as the two new heads are ready.

Lake—The additional machinery that this company is installing will soon go into commission and more drills will be started and a larger skip will be used.

Atlantic—This company has begun to sort its rock coming from section 16 shaft and is loading it into cars.

Victoria—This company has levied an assessment of $1 per share payable Jan. 11, 1909, in order to carry on extensive exploration in hopes of opening up a more consistent and better paying lode. The hydraulic plant is unable to operate continuously owing to the scarcity of water.

Quincy—This company is encountering some exceptionally good ground in its No. 9. or Pontiac shaft. This shaft is the most northerly of the openings and is down about 200 ft. on the Pewabic lode.

Lake—A shaft house is being erected. The enlarged equipment has gone into commission and greater progress will be made in opening the property. Conditions underground remain unchanged and the drifts in both directions from the second level are in the same highly mineralized formation.

Ojibway—At No. 1 shaft of this property the crosscut from the first, or 500-ft. level has encountered the second bed of the Kearsarge series and has all the indications of carrying the same high mineralized ground as the one previously encountered. The formation cut by the crosscut from the same level of No. 2 shaft is somewhat shattered, but not so much as in the level above, indicating that as depth is reached this condition will be eliminated.

Kewcenaw—Sinking continues in the Medora shaft and the lateral openings from the lower levels are revealing a much better grade of stamp rock. The Phœnix mill continues operating one shift per day and is handling about 120 tons daily.

Wyandot—Drifting on the recently encountered amygdaloid formation continues and the copper-bearing portion has widened to about 12 ft., carrying some mass and heavy copper and epidote.

Copper Range Consolidated — The Champion and Baltic properties are shipping about 3000 tons of rock to the mills daily and the underground conditions are in fine shape throughout. The Tri-

mountain is shipping about 1000 tons daily. Diamond drilling is now under way on sections 7 and 8, now held under option from the St. Mary's Mineral Land Company. It is expected that the Atlantic lode soon will be penetrated.

Franklin—This company is preparing to commence drifting from the 24th level of No. 1 shaft on the Pewabic lode. It is upon this formation that the life of the property now depends.

Missouri

ZINC-LEAD DISTRICT

Dr. Boyd Land—A 300-ton mill is to be erected on the Cameron lease on this land at Sarcoxie.

Nortonia—This mine has resumed work after a long shutdown.

Montana

BUTTE DISTRICT

North Butte Mountain—E. H. Wilson is in charge of operations at the company's mine just north of the city. The shaft has reached a depth of 240 ft., and is being sunk under a contract which calls for a depth of 500 ft. When the 250-ft. mark is reached a station will be cut and crosscuts run north and south.

Tuolumne—The shaft is down nearly 1100 ft., and sinking will be continued down to the 1600-ft. level, stations being cut every 200 ft. The crosscut on the 1000 has intersected three veins. One cross-compound condensing two-stage Nordberg air compressor and six 150-h.p. boilers, with 150 lb. pressure per sq.in. are being installed.

Butte & Balaklava—The shaft, now down 1050 ft., is being sunk to the 1200-ft. level. On the 1000 a station has been cut and a crosscut run which has intersected three veins. The veins range from 26 to 32 ft. in width, and all show copper, gold and silver. When the 1200-ft. mark is reached in the shaft a large station will be cut and an electric pump installed before any development work is done on that level.

LEWIS & CLARK COUNTY

Pittsburg & New York Copper Company—At the Umatilla group, seven miles west of Helena, the mill is being put in shape and the cyanide plant will soon be ready for operation.

FERGUS COUNTY

Abbey Gold Mining and Milling Company—John R. Cook, general manager, states that a 100-ton mill is to be erected at once on the claims near Kendall. About 1000 ft. of development work has been done on the property.

Barnes-King—Manager McGee made his monthly report for October last week to President John Gillie. Owing to an unusually severe storm at Kendall in October the transmission line was blown down and operations suspended entirely for 10 days so that the showing made for the month was below the average. The mine produced bullion of the gross value of $24,056.79 and the net value of $23,982.40. The latter sum is about equal to the operating expenses of the mine.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Combination Fraction—This week the shoot of ore that is being mined on the 300-ft. level has been found on the 450-ft. level. Work on the 612-ft. level will now be pushed to find the same oreshoot.

Grizzly Bear—A lease on this claim of the Consolidated has been granted to F. A. Lucy and associates.

Elk-Consolidated—This lease on the Yellow Tiger has been granted an extension of five years to its lease. It has the only steel gallows frame in the camp and has a fine plant of machinery. It was closed down several weeks ago, soon after the finding of pay ore at the 600-ft. level, when a large flow of water was cut. The shutdown, unexplainable at the time, now appears to have been for the purpose of extending the lease and preparing future plans for development.

Mushett Lease—This lease in the Laguna has now been acquired by the Hazel Goldfield, which owns the Hazel lease adjoining, and on which is the deepest shaft in the camp. Permission has been obtained from the Consolidated to work the Mushett ground from the Hazel shaft; work on both leases is now being pushed.

Little Florence—A 100-h.p. double-drum hoist is being installed, which is so arranged that it can use either electricity or gasolene for motive power. In addition to the present 6-drill compressor, a 15-drill compressor is being installed.

Consolidated—The old Mohawk dumps are being shipped to the new mill; about 1000 tons of ore have been put into the main ore bins at the mill ready for the stamps. The crushing plant, conveying machinery and sampling mill are in operation, but the whole mill will probably not be ready to run inside of 60 days.

Florence—A new lease has been granted to Pollard and associates on the block of ground formerly operated by the Florence Aurelia company on the Red King claim. This adjoins the old Pollard Florence on the east and the Engineers lease in the south. The shaft is 330 ft. deep, while the Pollard Florence shaft is 500 ft. deep; in it several reach veins were developed and followed up to the Aurelia line.

Atlanta—The Century lease has resumed work. The shaft now down 350 ft. will be sunk to a depth of 650 feet.

Nancy Donaldson—Work has been resumed at this group in the east slope of Red mountain in the extreme northeast part of the camp. Some small bunches of high-grade ore were found in the shallow workings.

Combination Extension—J. K. Walsh, of Los Angeles, has been granted a two-year extension of his lease. The two-compartment shaft, now 416 ft. deep, will be sunk several hundred feet deeper.

Florence Annex No. 2—A second shipment of ore has been made; this ore will average higher than the first shipment which, although not carefully sorted, assayed about $60 per ton.

Kewanas—The new vertical shaft is now 450 ft. deep; a crosscut will be run to the orebody found on the 500-ft. level in the old incline shaft. This will give about 100 ft. of backs.

Mohawk Ledge—An oreshoot 6 ft. wide has been opened up at the north end of the 300-ft. level, and a shipment from it has already been made. This is thought to be the extension of the Sheets-Ish-Kalfus shoot.

Crackerjack—This shaft on the western slope of Columbia mountain is now 400 ft. deep. Both crosscutting and sinking are in progress.

Black Butte—The company has had the old workings of the Huntzinger lease which was abandoned after an expenditure of several thousand dollars examined by an expert who found a vein cut by the former management which averages $200 per ton. Ore from this find is now being shipped.

Nevada Florence—Under this new name the old Chicago Florence is being worked. The shaft, now 400 ft. deep, will be sunk to a depth of 700 ft. Drifting has begun on the 400-ft. level.

NYE COUNTY—BULLFROG

Homestake King—The 25-stamp mill which is treating 75 tons of ore per day has sent two gold bricks to the mint. This bullion is worth about $8000, and was obtained from a partial clean-up of a two-weeks' run.

Springdale Mining and Milling Company—The last shipment of machinery has arrived, and the company's mill is expected to be running in about three weeks. The plant has a capacity of 40 tons per day.

Montgomery Mountain—Samuel Newhouse has given orders to resume operations. A shaft is to be sunk to a depth of 400 ft., and two veins that have been developed near surface will be prospected at that depth. This shaft when completed will be 550 ft. deeper than the collar of the neighboring Shoshone shaft, and 400 ft. below the Montgomery Mountain adit.

Montgomery Shoshone—The glory-hole talc deposit is still furnishing a large part of the 4000 tons of ore milled each month. This talc body has been proved for a length of 300 ft., and a width of from 40

ft. to 100 ft. Considerable of this talc ore is still held in reserve.

NYE COUNTY—ROUND MOUNTAIN

Round Mountain Hydraulic Mining Company—This company has purchased the Gordon-Garrecht lease on the Blue Jacket group and will replace the dry washers of the original leasers by a hydraulic giant which will wash 100 to 150 tons of gravel per day. A thorough prospecting of the ground is going on, but the location of the giant has already been fixed and the sluice boxes are now being put in place. The water main has been tapped near the incline on the Antelope lease so that a good head of water is available.

Sphinx—The mill is running at full capacity on ore coming solely from development work; no stoping is being done.

NYE COUNTY—TONOPAH

The total output of the Tonopah mines for the week ending Nov. 21 amounted to 5325 tons valued at $133,125. The Tonopah Mining Company mined 3100 tons; Belmont, 800; Montana Tonopah, 625; Midway, 100; MacNamara, 350; West End, 100; Jim Butler, 250 tons.

Belmont—On the 1100-ft. level, the crosscut from the east drift, which passed through 38 ft. of quartz and struck what was then supposed to be the hanging wall, has been advanced 23 ft. and is still in vein material. Big bunches of milling ore and stringers of richer ore are frequently found; the ground is much broken up.

Montana Tonopah—Several finds of importance have been made this week; two of these are on the first or 390-ft. level in the west drift where a new shoot of ore has been found about 600 ft. west of the shaft. There is 2 ft. of good milling ore in the face. In the south crosscut, 400 ft. west of the shaft, the faulted portion of the oreshoot that was lost in the east drift has been found. The ore is oxidized and of good grade. A good streak of high-grade ore has been cut in the raise driven from the top of the 465-ft. level stope.

Tonopah Mining Company—Work in the Mizpah shaft has been stopped for a week in order to watch the progress of the water which appeared in the bottom. After the water rose to a depth of 12 in., no increase in the water was noted and a drill hole sunk down 14 ft. failed to show any further flow. A crosscut has been started on the 1200-ft. level and is now 65 ft. long, the face being still in dacite. The drill hole from the 740-ft. level of the Silver Top shaft is now 154 ft. deep.

MacNamara—Six machine drills are now in use, four in ore and two in development work, the air being obtained from the Tonopah Extension power house.

Tonopah Extension—The station on the 35-ft. level has been completed, and work on the lower levels has been resumed. The crosscut in the new level has been driven north 40 ft., and has now been turned west.

STOREY COUNTY—VIRGINIA CITY

Butters Plant—A shipment consisting of 1000 lb. of precipitates from the Montana-Tonopah mill has been received at the Butters plant in Six Mile cañon. This is the first outside lot of precipitates sent to the Butters plant; quicker returns will be given than if the precipitate was sent to California or Utah.

WHITE PINE COUNTY—NEWARK

Newark Mill and Mining Company—The old Newark mill, erected in 1866, has been started up and has made its first shipment of silver-lead-copper concentrates to Salt Lake smelters. A second shipment is ready.

New Jersey

WARREN COUNTY

The closing down of the copper mine at Pahaquarry, near the Delaware river, which was recently reported, was for the purpose of installing new machinery. This machinery is now being delivered at the mine, and it is expected that it will be in place by January, when work at the mines will be resumed.

North Carolina

BUNCOMBE COUNTY

Great Southern Mica Mining Company—This company has leased property at Asheville, and it is reported that it will concentrate all its manufacturing plants in that town. At present it has several small plants at different points.

New Mexico

GRANT COUNTY

Gold Pass—This camp, about 30 miles southwest of Hachita, was discovered about three weeks ago. The ore, while low-grade, is said to occur in wide veins.

SANTA FE COUNTY

Cash Entry—This old mine has been bought by the Boston Cerrillos Mines Corporation. Houses for the men and for sheltering the machinery are being built; mining will be resumed this winter. In the past this mine produced much ore.

Oklahoma

There were 258 new oil wells completed in Oklahoma in November, of which 246 were oil producers, five gas producers and seven dry holes. There were 278 wells in progress at the end of the month.

The production of petroleum in November was 3,580,725 bbl. Deliveries by rail and pipe line were 3,225,282 bbl., and 355,483 bbl. were stocked in tanks. The total stocks reported on hand Nov. 30 were 51,535,580 bbl., held in the State. Oklahoma oil stored in Texas tanks is not included.

Washington

FERRY COUNTY

New Republic—This company, recently formed to operate the abandoned Republic mine, has begun work by hand, while awaiting the arrival of hoist and compressor.

Walla Walla Copper—This company, formed by a company of Walla Walla men to work properties in the Keller district, has consolidated a number of claims and will begin development this month. The properties lie near the Keller smelter.

Manila—This mine has about 1200 tons of ore stored in bins, ready for the blowing in of the smelter. A new chute is being constructed to put ore from the mouth of the tunnel down at grade level.

Forest—The company recently took over the old Easter Sunday mine, 12 miles northeast of Orient, and expects to begin operations soon. A stamp mill has been ordered.

STEVENS COUNTY

German Silver Gold Mining Company—The company has sold out its holdings to E. W. Shively and L. Bryant, of Spokane, who expect to begin development at once. The showings are in lead-silver.

Old Bullion—Work has been temporarily suspended, while a hoist and drills are installed. Ore carrying gold, copper and silver of an aggregate value of $20 per ton was opened up at a depth of 100 feet.

OKANOGAN COUNTY

Grant Consolidated—The company has completed a six-mile wagon road from the mine to the railway, and is ready to ship ore. Work done last spring opened up two veins of concentrating copper ore about 40 ft. wide.

Wisconsin

ZINC-LEAD DISTRICT

Benton—The Beloit-Elmo has let a contract to the Galena Iron Works for a 50-ton mill.

Benton Development Company—Three sheets of high-grade jack were struck in the Drum lease at 72 ft. The main shaft at the Pittsburg-Benton is being sunk to the oil rock to take up the lower ore level; the upper run contains a sheet 2 to 4 ft. in thickness.

Corr—A new shaft, No. 4, is being sunk close to the line of the Garden City. Preparations are being made to rebuild the 50-ton mill destroyed by fire last month.

Garden City—This property, purchased recently by John Gubbins, of Chicago, made its first shipment of carbonate, as-

saying 45 per cent. zinc, to the American Zinc and Lead Smelting Company, at Deering, Kansas.

Philippine Islands

AMBOS CAMARINES

Paracale Miners' Association—The miners operating in the Paracale district have organized this association for the purpose of securing united action on matters of common interest. One of the objects is to obtain some improvements in the Malaguit river, which will furnish a harbor where coasting steamers can land, thus giving the district communication which is much needed. The officers are A. J. MacDonald, president; William Kane, vice-president; G. Armstrong, secretary and treasurer.

Paracale Gold Dredging Company—After many delays and difficulties, this company now has its dredge on the Paracale river working regularly. The production in September was 550 oz. gold. The gravel handled averaged 300 cu.yd. per day. In addition the company has saved a large quantity of black sand for future treatment.

Philippine Gold Dredging Company—This company, organized at Manila, has acquired a large area of placer ground on the Paracale river. It has brought the Risdon dredge formerly used on the Guinobatan river in Masbate, and removed it to the Paracale. It is also building a new dredge. The company is also testing by bore holes an area on the Malaguit river, which is believed to be good dredging ground.

Philippine Placers—A considerable amount of gold is saved from placers along the Malaguit and Paracale rivers by native workers, chiefly women, who pan out the gold with wooden washers, resembling the *batea* used in South America.

San Mauricio—This mine, at Mambulas, formerly worked by an English syndicate, has been taken up by a Manila company. Some 1500 ft. of the old slopes and drifts have been cleared out and retimbered, with such promising results that arrangements have been made to continue the work and put up a 20-stamp mill.

Tumbaga—This old gold mine, formerly owned by an English syndicate, is being unwatered and cleared out. The mine has not been worked since 1896. The main shaft is over 100 ft. deep. The old workings will be thoroughly prospected and extended if the results are favorable.

Canada

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore for the week ending Nov. 28 were as follows: Coniagas, 64,000 lb.; Crown Reserve, 60,000; La Rose, 217,910; McKinley-Darragh, 240,000; Nipissing, 249,130; O'Brien. 191,920; Silver Queen, 156,000; Silver Cliff, 40,000; Temiskaming, 60,000; Temiskaming & Hudson Bay, 60,000; Trethewey, 63,000; total, 1,401,960 pounds.

Badger—In clearing ground for the installation of the compressor a small vein carrying smaltite and calcite with bloom was encountered at right angles to vein No. 9. Drifting is being done on the latter vein at 200 ft., at which level a station is being cut. A contract for diamond-drilling has been let.

City of Cobalt—This company has declared a quarterly dividend of 3 per cent., with an additional 7 per cent. bonus. It has been decided to raise the capitalization from $500,000 in one dollar shares to $1,500,000.

Cobalt Lake—Since the winze has been sunk 50 ft. from the 85-ft. level on the big niccolite vein high-grade silver ore has been found with the niccolite. Nearly two carloads have been mined, the native silver contents of which are said to run 5000 oz. to the ton.

Hargrave—The old shaft is being pumped out and sinking will be started as soon as possible. Machinery has been ordered.

Mount Royal—The reorganization of the Green-Meehan mine and its amalgamation with the Red Rock property have been effected and the new company will be known as the Mount Royal. W. B. Russell, Arthur Ferland and Wm. C. Chambers, as trustees for the controlling syndicate, purchased 694,000 shares of Green-Meehan placing in the treasury $60,000 for development purposes to be spent at the rate of at least $3500 per month. Green-Meehan shareholders are to receive shares in the new company equivalent to their holdings in the Green-Meehan.

ONTARIO—LONG LAKE DISTRICT

Richardson—A vein of good zinc ore, 800 ft. long and varying in width from 1 ft. to 4.5 ft. has been struck at this mine in Frontenac county, and is considered the best find so far made in the district.

ONTARIO—WELLAND COUNTY

British American Smelting Company—The smelter at Chippawa is working to full capacity on ore from the La Rose mine, Cobalt. Thirty men are employed. The capacity of the plant will be enlarged in the spring.

ONTARIO—LARDER LAKE DISTRICT

Harris-Maxwell—A 10-stamp mill is running 24 hours per day treating 30 tons of ore daily. The workings comprise a tunnel driven 100 ft. into the bluff at the end of which a crosscut is run 50 ft. to the west through paying ore. Forty more stamps with compressor, boiler, etc., will be installed during the winter.

Reddick—New machinery is being installed, which will raise the capacity of the plant to 150 tons per day. The ore now being treated is running more than $9 per ton. A strike of rich ore was recently made in No. 3 shaft which is said to run in places more than $500 to the ton.

Mexico

CHIHUAHUA

Santander—This mine, in the Santa Eulalia district, the property of C. O'Calahan, is producing 10 tons per day of 200-oz. silver ore. It is one of the new mines.

Chicago—Work is about to begin on this copper mine near Coyame in the eastern part of the State. The mine is on the same vein as the Las Vigas.

Rio Plata — November production amounted to 63,120 oz. exclusive of tailings. Net returns on shipments were $36,803, and applied on account of operating expenses $11,041. The cyanide plant is expected to be in operation in February when the output will be doubled.

Palmarejo—Important improvements are under consideration, among them moving the mill to the mines to do away with the railroad haul.

JALISCO

Cinco Minas—A payment has been made on the purchase price of this property in the Hostotipaquillo district by a representative of the Marcus Daly estate. An option was granted a short time ago by Martinez and Cardona, the owners. The purchase price is said to be in excess of $500,000. New work will begin at once under the direction of H. E. Crawford. The plans include a big reduction plant.

Magistral Ameca Mining Company—This company is in process of organization at Spokane, Wash., to work properties at Ameca. The officers contemplate the erection of a 100-ton concentrator to treat the bornite and chalcopyrite ore.

MICHOACAN

Dos Estrellas—During October the mills worked without interruption and treated 24,633 tons of ore, the total production having a value of $661,242. Expenses of the mines, including exploration, development and taxes, were $325,913, and $15,455 worth of new machinery was installed.

New Caledonia

Shipments of ores from the colony in September and the nine months ended Sept. 30 are reported by the *Bulletin du Commerce* of Noumea as follows, in metric tons:

	September.	Nine Months.
Nickel ore	9,557	96,619
Cobalt ore	560	3,023
Copper ore	7	10
Iron ore	11	33
Chrome ore	3,070	37,175

In addition to the above there were shipments during the year of 5 tons of lead and 5020 kg. silver.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Dec. 9—The coal trade in the West generally is quiet, showing little or no advance in the demand for steam coal. Mines are not generally running full time, but there are complaints at consuming centers of over-supply, and consequent low prices. Continued mild weather has kept down the domestic demand. The Lake trade is now over for the season, and if more coal should be needed in the Northwest it will have to be shipped by rail.

The Seaboard bituminous market remains dull and quiet. Mines are not working to capacity, but the supply seems to meet all demands. The requirements for steam coal do not increase as rapidly as was expected. Manufacturers generally do not seem inclined to put in more coal than they need for the time being.

Anthracite coal is also dull, partly on account of the weather, which keeps down the domestic demand. The shipments from the mines hold up well, but a considerable quantity must be going into the storage yards which all the large companies have.

Coastwise trade is falling off, though perhaps not more than is usual at this time of the year.

Coal Traffic Notes

Tonnage originating on Pennsylvania lines east of Pittsburg and Erie, year to Nov. 28, in short tons:

	1907.	1908.	Changes.
Anthracite	5,192,324	4,714,361	D. 477,963
Bituminous	36,373,435	30,797,276	D. 5,576,159
Coke	12,533,292	6,465,059	D. 6,068,233
Total	54,099,051	41,976,696	D. 12,122,355

Total decrease this year to date was 22.4 per cent.

Shipments of Broad Top coal over the Huntingdon & Broad Top railroad for the 11 months ended Nov. 30 were 902,291 tons in 1907, and 560,556 tons in 1908; a decrease of 341,735 tons, or 37.9 per cent.

Coal receipts at Boston 11 months ended Nov. 30, reported by Chamber of Commerce, in long tons:

	1907.	1908.	Changes.
Anthracite	1,874,654	1,619,800	D. 254,854
Bituminous	2,897,561	2,971,968	I. 74,407
Total domestic	4,772,215	4,591,768	D. 180,447
Foreign	491,439	338,808	D. 152,631
Total	5,263,654	4,930,576	D. 333,078

The foreign coal reported comes chiefly from Nova Scotia.

Anthracite coal shipments reported in November were 5,839,481 long tons; being 158,016 tons less than in October, but 93,959 tons more than in November, 1907. For the 11 months ended Nov. 30 the shipments were as follows, in long tons:

	1907.	1908.	Changes.
Reading	12,877,537	11,319,218	D. 1,558,319
Lehigh Valley	10,625,844	9,923,239	D. 702,605
N. J. Central	8,008,359	7,723,250	D. 285,109
Lackawanna	9,461,117	9,149,286	D. 311,831
Del. & Hudson	6,062,977	5,851,302	D. 211,675
Pennsylvania	5,658,115	5,495,328	D. 162,787
Erie	6,589,601	6,826,889	I. 237,288
N. Y., Ont. & West.	2,482,366	2,548,566	I. 66,200
Total	61,765,916	58,837,078	D. 2,928,838

The total decrease this year is 4.7 per cent. Only two companies—the Erie and the New York, Ontario & Western—show increases. The larger proportional losses were on the Reading and the Lehigh Valley.

New York

Anthracite

Dec. 9—The demand for both prepared and small steam sizes has abated and hard coal is in good supply.

Schedule prices are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam prices are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50. All prices are f.o.b. New York harbor points.

Bituminous

The soft-coal market is dull in all consuming territories, especially so in New York harbor, where good grades of steam coal fetch $2.45@2.65 with poorer grades as low as $2.30. Transportation is fair and cars are in good supply. In the Coastwise vessel trade boats do not seem to be scarce. Freight rates remain unchanged. Quotations are as follows, for large vessels from Philadelphia: To Boston, Salem and Portland, 70@80c.; Lynn, Newburyport and Bath, 80@85c.; Portsmouth, 80c.; Bangor, $1@1.10; Providence, New Bedford and the Sound, 70@75c. per ton.

Birmingham

Dec. 7—Coal operations in Alabama show some improvement. The production in several of the larger collieries is approaching normal again and before the holiday season sets in it is believed there will be a general return to the usual output. The railroads are handling the product promptly. A little car shortage is reported in some sections, but this will not be extensive. The Car Service Association reports a larger number of cars being handled in the coalfields than for the past 14 months. There is considerable coal being shipped out of the district, much of it going to Louisiana and Mississippi markets.

Coke is in strong demand and good prices are obtaining for it. The production continues to show an increase.

Chicago

Dec. 7—The coal market continues steady and comparatively free from accumulations of demurrage coal, shipments being generally restricted. There is some depression of prices on screenings and on lump from Western mines, but the consumption of both steam and domestic coals, speaking generally, is increasing, and the tone is firmer than for many weeks. The coming of cold weather throughout Chicago territory has appreciably increased sales of anthracite and domestic bituminous. Advertising has aided the sales of the best brands of smokeless, though run-of-mine smokeless continues in large supply.

Lump and egg from Illinois and Indiana mines bring $1.75@2.65; run-of-mine sells for $1.65@1.75, and screenings are sluggish at 95c.@$1.55. Hocking is in good demand and fairly restricted supply at $3@3.15, Youghiogheny moves on contracts at $3.15 for ¾-in. gas and Pittsburg No. 8 is steady at $2.65@2.85. Smokeless brings $2.85@3.30 for run-of-mine. Anthracite moves steadily to both retailers and consumers, with nut coal much in demand, but not so scarce as in former years. The demand for steam coals seems to be steadily increasing, and there is a feeling in the trade that weather conditions are bound to continue the good demand for domestic sizes and grades that is satisfactorily shown in both city and country with the beginning of this week.

Indianapolis

Dec. 7—Indiana coalmen and mine operators are interested in the plan of an outlet for Indiana coal for the South, announced by the River & Rail Coal Company. This company proposes to build at once a $200,000 coal dock at Uniontown, across the Ohio river at Evansville. The Evansville & Terre Haute railroad runs direct from the Indiana coalfields to Evansville. The River & Rail company has notified Indiana operators that it will be glad to handle Indiana coal for shipment to Ohio and Mississippi.

There has been a slight improvement in the mining conditions of the block-coal

district during the past week, but the improvement has not been sufficient to bring the relief that is needed. Work in this coalfield is considerably below the average for this season of the year. These conditions prevail to some extent, all over the State. The operators give as their opinion that the slack work is due to the mild winter and the unsettled condition of the country. They further say the only relief that could come is through severe cold weather, for at least a month or two.

Pittsburg

Dec. 8—The general coal market continues dull and prices are much softer, with but little new business. Large operators continue to hold to quotations based on mine-run at $1.15 at mine and slack around 75c. A number of small sales have been made during the week at considerably less and for prompt shipment there would be no difficulty in buying mine-run coal at $1. Several important coal interests in the Pittsburg district met informally Dec. 7, and decided to arrange for a general meeting to discuss conditions and devise a plan for improving the situation. The large steel companies have provided by long term contracts with different companies for their requirements and there is but little business outside. This week not more than 50 per cent. of the railroad mines are in operation and the river mines are all idle.

Connellsville Coke—Conditions in the coke trade show no improvement and prices for prompt shipment are weaker. Producers still adhere firmly to the quotation of $2 a ton for furnace coke for first-half delivery and for foundry coke $2.25@2.40 at ovens. Production is about 53 per cent. of capacity and this percentage will not likely be increased until after the opening of the new year when a number of idle furnaces are expected to go in blast. For prompt shipment regular prices of both foundry and furnace coke have been shaded 10@25c. a ton. A number of inquiries for coke for delivery through the year have been received, but producers hesitate about taking this business. One or two large sales of foundry coke have been made for the year at $2.60 a ton. The *Courier* gives the production in both of the Connellsville regions at 229,199 tons. The shipments were 8364 cars as follows: To Pittsburg district, 3238; to points west of Pittsburg, 4623; to points east of Connellsville, 503 cars.

Foreign Coal Trade

United States Coal Imports—Imports of coal and coke into the United States, 10 months ended Oct. 31, long tons:

	1907.	1908.	Changes.
Anthracite	3,101	15,029	I. 11,928
Bituminous	1,719,327	1,279,470	D. 439,857
Total coal	1,722,428	1,294,499	D. 427,929
Coke	108,508	95,779	D. 12,729

Canada furnished this year 924,593 tons of coal and nearly all the coke; Australia, 306,924 tons of coal. Imports are chiefly on the Pacific Coast.

United States Coal Exports—Exports of coal from the United States, with coal sold to steamers in foreign trade, 10 months ended Oct. 31, long tons:

	1907.	1908.	Changes.
Anthracite	2,336,304	2,334,931	D. 1,373
Bituminous	8,675,258	7,558,962	D. 1,116,296
Total exports	11,011,562	9,893,893	D. 1,117,669
Steamer coal	4,735,620	5,014,168	I. 278,548
Total coal	15,747,182	14,908,061	D. 839,121
Coke	761,568	498,907	D. 262,661

Canada took this year 7,766,932 tons of coal, or 78.5 per cent. of the total exports.

Coal in Russia—The production of coal in Russia is officially reported at 19,624,700 metric tons in 1904; 18,683,800 in 1905; 20,664,411 in 1906; and 26,023,344 in 1907. The increase last year over 1906 was 5,358,933 tons, or 26 per cent.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report prices as follows on Nov. 28: Best Welsh steam, $3.48; seconds, $3.36; thirds, $3.24; dry coals, $3.60; best Monmouthshire, $3.18; seconds, $3.06; best small steam, $1.92; seconds, $1.56. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Dec. 9—The iron and steel markets have been generally quiet during the week, and it looks as if buying beyond present requirements had subsided for the present, probably until the close of the year. Part of this is probably due to the expectation that there will be some reduction in the tariff, and consequent lower prices. At any rate the markets seem to be in rather a waiting condition. Some action on prices is looked for also, as the possible result of the gathering of steelmen set for Dec. 10, in New York.

Pig-iron sales have been light, though orders on contracts are reported to be coming in quite freely. Foundry iron is most in demand for new sales, the inquiry for basic having fallen off. In finished material orders for structural steel are evidently held back. Actual sales are much lighter than they were a week or two ago; and will probably continue lighter until the price question is settled. The railroads are making no sign, and the rail orders for next year are still a very uncertain quantity.

A special feature is the growing demand for heavy steel scrap from the open-hearth steel makers. At present it seems uncertain whether this demand can be met without an advance in prices.

Lake Iron Ore Shipments—A Duluth estimate of the total iron ore shipments from the Lake Superior region for the season is 25,421,000 tons, of which 17,232,000 tons, or 67.8 per cent., were from the Mesabi range. Shipments by lake are now closed. The last ore to leave was two cargoes from Escanaba, which started this week, and are not included in the total above given.

Baltimore

Dec. 8—Exports from this port for the week included 631 tons steel rails and 531,934 lb. structural steel to Colon; 1,628,588 lb. tin scrap to Rotterdam.

Birmingham

Dec. 7—Southern pig iron manufacturers have announced an advance in quotations, though the new price has not yet become general. No. 2 foundry iron has been quoted at $13.50 per ton, 50c. above the price that has been in vogue for some time; but as yet there have been but few sales made, if any. Some sales were made during the past week for delivery during the second quarter of 1909 at $13 per ton. Two furnaces at Bessemer have been dried out and it was believed they would be making iron by now but there has been some delay. There has been no difficulty experienced in selling iron, and several companies have been out of the market for more than a week for iron to be delivered during the first quarter.

Raw material supplies are being given some attention, especially in ore. The coke production is healthy, as well as the limestone. The ore situation promises to be easy even when several other furnaces are blown in.

There is no change at the Ensley steel works of the Tennessee company. There are many orders being received and when the new year starts in there will be a double force put on in every department.

There is but little accumulation, if any, in this district in the way of pig iron. The shipments are in all directions. A little iron is being sold for immediate delivery. Some of the larger consumers are asking for quick shipments of iron.

Cast-iron pipe makers are doing a steady business. The United States Cast Iron Pipe and Foundry Company has landed the Cuban order for 15,000 tons of pipe and the greater portion of the business will be supplied from the Alabama plants.

Chicago

Dec. 7—Sales of pig iron are not large, but are fairly steady for the needs of the first and second quarters and well distributed. Melters have apparently no intention of contracting heavily for their needs and much tonnage, it is figured, remains to be placed for the first half. The feeling is strong toward conservatism on the part of both sellers and buyers, with no weakening of prices and no expectation of more than the customary dullness due to the coming of the new year. Lots for second-half delivery are occasionally placed.

Southern iron remains the favorite of buyers at $13 Birmingham ($17.35 Chicago) for No. 2, and Northern No. 2 is quoted at $17 minimum for the first quarter. Above these quotations there is 25@50c. range for second-quarter sales and special lots. Northern charcoal iron is quiet with no special features, at $19.50 @20.

Iron and steel products remain steady and in general firm, with good sales and prospects of steadiness until after the opening of the new year. Coke is strong at $5 for first-class Connellsville.

Philadelphia

Dec. 9—Very little business is reported today by the pig-iron makers. The bulk of buyers have all the iron they want just now, and furnace owners say they have enough business to satisfy them for the present. Offers were submitted this week for considerable lots, which are held under advisement until after the turn of the year. Foundry iron is more inquired for, and nothing has been done in basic. Forge is dull and weak. More iron is being melted, and makers assert the situation is in their favor, but this depends upon the capacity that may be blown in in the next few weeks. A few large consumers have just closed for delivery of Southern iron.

Steel Billets—The outlook for steel billets has materially improved and large orders are almost in sight. Prices are firm.

Bars—Bar mills are actively seeking business, but are not making concessions. Quotations remain the same. Car builders are not buying as much as their reported contracts would seem to require.

Structural Material—Active figuring is going on for a large amount of work which may or may not be wanted in the next 60 days. The present situation is not altogether encouraging.

Scrap—Scrap dealers are acting on the theory that there will be a general expansion of demand during the coming quarter. Actual sales are light, and prices are firm. Stocks are being held firmly, and dealers are quietly scrambling for supplies, with the effect that scrap is creeping up fractionally.

Pittsburg

Dec. 8—One of the few bright spots in the iron and steel trade this week is the report, evidently based on substantial authority, that the rail-makers and railroads have reached an agreement on specifications and that some large contracts for steel rails will be placed shortly. A representative of one large rail producing interests said today that every indication points to rail buying before the end of the month. The railroads, however, will not contract for their full 1909 requirements at one time as formerly. While it is assumed that the various roads will take at least 3,000,000 tons for next year it is not likely that more than 500,000 tons will be placed this and next month. The possibility of tariff changes is one reason assigned for the delay of the railroads and another is a lack of funds to carry on extensions that are under consideration.

In finished lines there is a gradual improvement and large concerns report that business in November was greater than in October, which was the best month of the year. December opened with many good orders in different lines and heavy specifications against old contracts. As a result the Carnegie Steel Company is operating its Duquesne and Clairton works to full capacity and the Homestead plant at around 90 per cent. Arrangements have been completed for starting the steel plant at Mingo Junction, which has been idle since the depression began late last year.

Pig Iron—The market is dull as to actual transactions, but strong as to prices. With the exception of one or two furnaces, the prices named are being firmly adhered to, quotations for December and first-quarter delivery being: Standard bessemer, $16.50@17; basic, malleable bessemer and No. 2 foundry, $15.50@16; gray forge $14.50@15; all f.o.b. Valley furnaces. Sales so far this week are light and include small lots of malleable bessemer, at $15.75, standard bessemer at $17 and No. 2 foundry at $16. Buyers are hesitating because the Westinghouse Electric and Manufacturing Company recently bought 5000 tons for second-quarter delivery at a trifle less than $15.50 for No. 2 foundry.

Steel—There is no change, the only transactions in billets being on sliding-scale contracts. Both bessemer and open-hearth billets are still quoted at $25, merchant-steel bars at 1.40c. and plates at 1.60c., Pittsburg.

Sheets—An improvement is noted and prices are firm. Production has been materially increased owing to increase in demand. Black sheets are firm at 2.50c. and galvanized at 3.55c. for No. 28 gage.

Ferro-Manganese — The market continues strong with quotations for prompt shipment $46.50@47. Indications point to a higher price after the opening of the first quarter.

Foreign Trade in Iron and Steel

Iron and Steel Imports—Imports of iron and steel, including machinery, into the United States for the 10 months ended Oct. 31 were valued at $34,116,740 in 1907, and $16,389,031 in 1908; a decrease of $17,727,709, or 52 per cent. Leading items of imports, in long tons:

	1907.	1908.	Changes.
Pig iron	459,040	73,383	D. 385,657
Scrap	25,619	3,748	D. 21,871
Ingots, blooms, etc.	13,044	7,762	D. 5,282
Bars	32,716	15,801	D. 16,915
Wire-rods	14,295	9,503	D. 4,792
Tinplates	51,846	51,368	D. 478

All items show decreases. Tin plates increased up to October, but imports in that month were light.

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for the 10 months ended Oct. 31, are valued by the Bureau of Statistics of the Department of Commerce and Labor at $165,017,157 in 1907, and $127,985,824 in 1908; a decrease of $37,031,333, or 22.4 per cent. Leading items of export, in long tons:

	1907.	1908.	Changes.
Pig Iron	64,415	37,089	D. 27,326
Billets, ingots & blooms	66,133	96,752	I. 30,619
Bars	84,667	42,625	D. 42,042
Rails	288,002	175,462	D. 112,540
Sheets and plates	102,563	85,058	D. 17,505
Structural steel	117,774	100,527	D. 17,247
Wire	132,299	111,041	D. 21,258
Nails and spikes	50,019	31,735	D. 18,284

Considerable decreases are shown.

Iron Ore Movement—Exports and imports of iron ore in the United States for the 10 months ended Oct. 31 are reported as follows, in long tons:

	1907.	1908.	Changes.
Exports	224,421	262,113	I. 37,692
Imports	1,055,701	560,840	D. 494,861

Imports of manganese ore for the 10 months, 173,045 tons in 1907, and 154,698 in 1908; decrease, 18,347 tons.

Metal Markets

New York, Dec. 9—The metal markets generally have shown only moderate activity during the week, with no special changes. Silver has reacted a little from the lowest price, but is still below 50 cents.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Oct. 1908..	$ 1,952,574	$ 3,782,705	Imp.$ 1,830,131
" 1907..	3,716,258	4,512,466	" 796,208
Year 1908..	70,889,954	42,210,678	Exp. 28,679,276
" 1907..	53,596,071	35,374,686	" 18,221,385
Silver:			
Oct. 1908..	4,378,015	3,744,163	Exp. 633,852
" 1907..	5,053,997	3,599,695	" 1,454,302
Year 1908..	43,159,395	34,536,867	" 8,622,528
" 1907..	53,024,790	38,087,919	" 14,936,871

Exports of specie from New York week ended Dec. 5: Gold, $1,671,025, to Paris and Panama; silver, $1,207,039, chiefly to London. Imports: Gold, $340,925, mostly from Cuba and the West Indies; silver, $185,464, from Mexico and Central America.

The Bank of France now has what is probably the greatest accumulation of specie ever held by one banking institution. The reserve reported this week is $679,576,760 gold and $178,813,615 silver; a total of $858,390,375. The bank is still adding to its gold reserve.

Gold—Bar gold is quoted in London at 77s. 11⅛d. per ounce; American eagles, 76s. 6⅛d. Nearly all the gold arriving in London for the week was again taken for Paris account. No more gold has been taken in New York for shipment to Europe, and sterling exchange has fallen to a point which indicates that no more will go out at present.

Platinum—Dealers report a good business at unchanged prices: $24 per oz. for refined platinum, $26.50 for hard, and $20@21 for scrap. The market is firm.

Silver—Under the influence of some speculative covering silver has shown a slight disposition to react. It is thought the Indian bazars may ship silver back to London, perhaps next week. That would have a tendency to check the advance.

Silver

SILVER AND STERLING EXCHANGE.

Dec.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	Dec.	Sterling Exchange.	Silver. New York Cents.	Silver. London, Pence.
3	4.8675	48¼	22⅛	7	4.8645	48½	22⅜
4	4.8665	48	22⅛	8	4.8655	48¾	22 5/16
5	4.8650	48⅜	22 5/16	9	4.8685	49	22⅜

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

In the table in the JOURNAL of Dec. 5, the price of silver in London on Nov. 28 was given at 23 3/16d., through a typographical error. It should have been 22 3/16d., as was evident from the context.

Copper, Tin, Lead and Zinc

Dec.	Copper. Lake, Cts. per lb	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
3	14⅛ @14¼	14⅛ @14¼	63	29⅜	4.25 @4.30	5.12½ @5.15	4.97½ @5.00
4	14⅛ @14⅜	14⅛ @14¼	62¾	29⅜	4.25 @4.30	5.12½ @5.15	4.97½ @5.00
5	14¼ @14⅜	14⅛ @14¼	....	29¼	4.25 @4.30	5.12½ @5.15	4.97½ @5.00
7	14⅛ @14⅜	14 @14⅛	62⅝	29	4.22½ @4.27½	5.12½ @5.15	4.97½ @5.00
8	14⅛ @14⅜	14 @14⅛	62¼	28¾	4.22½ @4.27½	5.12½ @5.15	4.97½ @5.00
9	14⅛ @14⅜	14 @14⅛	62⅝	29	4.22½ @4.27½	5.12½ @5.15	4.97½ @5.00

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—During the week ending Dec. 9 the market has continued dull, although the volume of business has shown a small increase over the previous week, some transactions having been made in electrolytic copper both with foreign and domestic manufacturers. The market for Lake copper has been particularly dull. All of the leading producers of Lake are well sold up and manifest no inclination to come into the market at the present level. The market for electrolytic has been influenced by the decline in standard abroad. The sentiment among producers as to the immediate future has become more mixed. Several producers continue to hold aloof pending the time when manufacturers will be compelled to buy, but other first hands have shown more disposition to meet the present market. An encouraging feature has been considerable inquiry for December copper, showing that all manufacturers have not covered their requirements for this month, but many appear to have covered their needs for some time ahead and to be waiting for a decided tendency one way or the other before extending their commitments. The copper in the weaker speculative hands appears to have been cleaned up; at least it has not been an important factor in the market this week; however, the larger speculative interests undoubtedly still exist. The market closes lifeless at 14¼@14⅜c. for Lake copper; 14@14⅛c. for electrolytic in ingots, cakes and wirebars. The average for casting copper has been 13¾@14c.

Copper sheets, cold-rolled, 20c.; hot-rolled, 19c. Wire, 15¾c. base, carload lots at mill.

The standard market in London has been depressed throughout the week, not so much on account of the quantities offered for sale, as the entire absence of buying power. The decline has established a wider margin between g.m.b.'s and refined sorts than has existed for some time past. It is reported that the bulk of the holdings is in strong hands, so that a material decline is not anticipated so long as refined copper is held at the present level of prices. The market after touching £62 5s. for spot, £63 5s. for three months, closes better at £62 12s. 6d. for spot, £63 17s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £66; best selected, £65@66; strong sheets, £77@78.

Tin—The decline in the London market has made further progress, but a firmer tone is reported at the close. Quotations are cabled as £132 for spot, £134 for three months.

There were no new features to the domestic market, where buyers remained rather reticent and covered only immediate or near requirements. Spot tin is rather plentiful and at the close can be bought at about 29 cents.

Lead—There has been a great deal of pressure to effect sales, particularly from Missouri, where producers have accumulated fair-sized stocks. Buyers, however, have not changed their attitude. The tariff agitation is, perhaps, an influence in the market, since consumers are reluctant to anticipate their wants even at the present low level of prices. The market closes weak at 4.22@4.27½c. New York, and 4.12½c. St. Louis.

Little interest is shown in the metal in London, and as a result transactions have been small. The close is steady at £13 5s. for Spanish lead, £13 7s. 6d. for English.

Spelter—In spite of the excitement in Joplin, where the scarcity of ore has caused an advance in its price away above the relative level of the price of spelter, the latter has not reflected this situation, due to the fact that the demand from consumers has been of small volume throughout the week. Any increase in the inquiry would bring about a quick advance in the price of spelter, as first hands necessarily are reluctant to sell their product for less than it costs them to make it. The close is firm at 4.97½@5c. St. Louis, 5⅛@5.15 New York. Metal for delivery several months ahead has fetched higher figures.

The London market has eased off somewhat and the close is cabled at £20 for good ordinaries, £20 5s. for specials.

Base price of sheet zinc is 7c. f.o.b. La Salle-Peru, Ill., less 8 per cent.

Other Metals

Aluminum—The Aluminum Company of America reports prices unchanged, and quotes 24c. per lb. base for No. 1 ingots; 33@34c. base for sheets. Foreign metal is still offered at 22c. for ingots in New York. There is some report of attempts to regulate prices abroad, but they are reported still at 14c. and even lower.

Antimony—The market is quiet and the volume of business is small. The foreign market is steady. Quotations are 8.15@8.25c. for Cookson's, 8@8⅛c. for Hallett's and 7⅝@7¾c. for ordinary brands.

Quicksilver—The New York price is unchanged, and quotations are $46@47 per flask of 75 lb. San Francisco prices are higher, at $45@46 per flask for domestic orders and $43@44 for export. London quotation is steady at £8 10s. per flask, with 1s. 6d. less named by jobbers.

Nickel—Large lots, 40c., New York.

Cadmium—In 100-lb. lots, 75c. per lb., at Cleveland, Ohio.

Magnesium—This metal is offered in New York at $1.25 per lb. in 100-lb. lots. The price is $1.40 per lb. for 5-lb. lots.

Imports and Exports of Metals

Exports and imports of metals in the United States for the 10 months ended Oct. 31 are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	258,969	75,065	Exp. 183,904
Copper, 1907....	158,911	99,341	Exp. 59,570
Tin, long tons....	192	29,246	Imp. 29,054
Tin, 1907.....	522	34,115	Imp. 33,593
Lead, short tons.	60,848	91,250	Imp. 30,402
Lead, 1907.....	41,497	62,490	Imp. 20,993
Spelter, sh. tons.	2,410	824	Exp. 1,586
Spelter, 1907....	414	1,763	Imp. 1,349
Nickel, lb.....	8,580,540	15,115,275	Imp. 6,534,735
Nickel, 1907....	7,490,062	15,720,017	Imp. 8,229,955
Antimony, lb.....	.....	6,901,591	Imp. 6,901,591
Antimony, 1907.	.....	6,913,074	Imp. 6,913,074
Platinum, oz.....	.....	31,802	Imp. 31,802
Platinum, 1907.	.....	62,364	Imp. 62,364
Quicksilver, lb...	214,100	.....	Exp. 214,100
Quicksilver, '07	346,118	.....	Imp. 346,118
Aluminum, value	$291,364	.....	Exp. $291,364
Aluminum, 1907	285,278	.....	Exp. 285,278

Ores, etc.:	Imports.	Exports.	Excess.
Zinc dross, lb.	14,580,283	.....	Exp. 14,580,283
Zinc dross, '07.	17,215,893	.....	Exp. 17,215,893
Zinc ores, lg. tons	23,311	41,052	Imp. 17,741
Zinc ores, 1907.	13,991	.....	.....
Antim'y ores, lb.	.....	2,400,584	Imp. 2,400,584
Ant. ores, 1907.	.....	2,604,650	Imp. 2,604,650

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include re-exports of foreign material. Zinc ores imported this year included 19,275 tons calamine and 21,777 tons other ores; not reported last year.

Zinc and Lead Ore Markets

Platteville, Wis., Dec. 5—This week $42.50 was the highest price paid for zinc ore on a basis of $40@42 per ton of 60-per cent. zinc. For 80-per cent. lead ore $52 per ton was paid.

SHIPMENTS, WEEK ENDED DEC. 5

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	844,445	.....	244,900
Benton	487,510	.....	.....
Hazel Green	326,000	67,700	.....
Cuba City	152,490	88,240	.....
Galena	140,000	.....	.....
Livingston	140,000	.....	.....
Strawbridge	70,070	.....	.....
Elmo	.....	41,150	.....
Linden	156,980	.....	.....
Highland	125,500	.....	.....
Harker	123,330	.....	.....
Mineral Point	40,000	.....	.....
Total	2,606,325	197,090	244,900
Year to Dec. 5	104,007,062	10,101,815	4,649,504

In addition to the above there was shipped to the Platteville Separating Company 308,960 lb.; to the Joplin Separator Works, 140,060 lb. zinc ore.

Joplin, Mo., Dec. 5—As high as $46.50 per ton was paid for sulphide zinc concentrate, and the base price ranged from $42 to $46 per ton of 60 per cent. zinc, the higher base price for concentrate carrying 60 per cent. or more zinc was $44 per ton. Silicate of zinc sold on a base price of $19 per ton of 40 per cent. zinc, the high price being $23. The average price, all grades, was $40.48 per ton. Lead concentrate weakened again, the closing price of the week being $50 per ton, but some ore was settled for from the previous week's purchases as high as $54. The average price, all grades, was $50.80 per ton.

No more strenuous conditions of the purchasing market were ever recorded than those of the past four weeks. This week a large proportion of the purchases were made by offerings of the highest base price that could be made. Buyers would tell their customers they would give a certain base price, or as high a base price as was offered by any other buyer, in order to secure an allotment of ore. This was done because the price was so changeable that a set bid would be immediately raised by some other.

The district value, for the year to date, just passes $10,000,000, or two-thirds of the value for last year. The zinc tonnage is 35,660 tons and the lead tonnage 4226 tons less than the same period of last year.

The same week last year zinc sold at $28@34 per ton of 60 per cent. zinc, the highest being $36; and lead sold at $40@42 per ton.

SHIPMENTS, WEEK ENDED DEC. 5

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,130,010	649,240	$103,290
Joplin	2,537,660	233,520	59,245
Galena	723,910	51,590	15,794
Granby	753,000	95,000	14,975
Duenweg	515,770	68,660	12,580
Spurgeon	448,180	160,140	11,639
Prosperity	434,200	47,780	10,335
Aurora	275,660	.....	6,095
Alba-Neck	189,510	.....	3,979
Badger	126,240	.....	3,877
Miami	305,090	.....	3,661
Quapaw	185,540	1,120	3,553
Zincite	145,490	3,660	3,150
Carthage	145,220	.....	3,121
Aurora	65,820	.....	1,415
Sarcoxie	55,490	.....	1,220
Playter	57,500	.....	1,150
Peoria	88,610	.....	975
Reeds	35,670	.....	392
Totals	11,218,570	1,310,710	$260,446
49 weeks	479,625,690	73,176,440	$10,158,342

Zinc value, the week, $227,148; 49 weeks, $8,147,984
Lead value, the week, 33,298; 49 weeks, 2,010,358

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	$46.90	$37.60	$45.84	$35.56	$83.58	$46.88
February	48.30	36.63	47.11	34.92	84.58	49.72
March	49.75	36.19	48.66	34.19	82.75	49.90
April	49.25	35.40	48.24	34.08	79.76	52.47
May	46.90	34.19	45.98	33.39	79.56	56.05
June	47.00	33.06	44.82	32.07	73.66	60.48
July	46.80	34.55	45.79	31.67	58.18	59.90
August	44.56	36.53	43.22	33.42	59.54	60.34
September	41.00	37.63	40.11	34.44	53.52	54.59
October	41.75	35.95	39.83	33.28	51.40	52.63
November	38.60	39.13	35.19	35.02	43.40	54.53
December	31.50	.....	30.87	.....	37.71	.....
Year	$44.36	.....	$43.68	.....	$68.90	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Dec. 9—The demand for general chemicals seems to be healthy and in good volume. Forward business is improving.

Copper Sulphate—The market is strong and no goods are available at less than standard quotations except, perhaps, a few small lots. Quotations are $4.75 per 100 lb. for carloads and up to $5 for smaller quantities.

Nitrate of Soda—Messrs. Mortimer & Wisner, New York, report the position of nitrate in the United States Dec. 1 as below; figures are in long tons:

	1907.	1908.	Changes.
Stocks, Jan. 1	13,050	5,900	D. 7,150
Imports, 11 months	285,845	265,850	D. 19,995
Total Supplies	298,895	271,750	D. 27,145
Deliveries, 11 months	293,145	257,850	D. 35,295
Stocks, Dec. 1	5,750	13,900	I. 8,150
Afloat for U. S. ports	60,000	50,000	D. 10,000

Quantities afloat include all cargoes due to arrive at United States ports by March 15 next.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States 10 months ended Oct. 31 were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.	.....	7,329,349	E. 7,329,349
Bleach, lb.	58,557,323	121,511	I. 58,435,812
Potash salts, lb.	203,302,728	822,527	I. 202,480,201
Soda salts, lb.	9,673,552	694,303	I. 8,979,249
Acetate lime, lb.	.....	49,652,450	E. 49,652,450
Nit. of soda, tons	262,007	8,785	I. 253,222
Phosphates, tons	21,027	1,099,095	E. 1,078,068
Sulphur, tons	17,751	20,046	E. 2,295
Pyrites, tons	557,418	.....	I. 557,418

Estimating sulphur contents of pyrites, the total sulphur imported was approximately 240,718 long tons.

Mining Stocks

New York, Dec. 9—The earlier part of the week showed much activity in the stock markets and some sharp advances in quotations. This movement subsided, however, and later there was a much slower market, with comparatively small trading and also with small fluctuations in prices. Further it is also in large part a professional market and with no decided tendencies. Money is plentiful, but the business revival is slower than had been expected. Many people evidently think that the advance in stocks has been greater than was warranted by actual conditions, and are, therefore, keeping out of the market.

On the Curb copper stocks were less in evidence, and the trading in them was only moderate. Price changes were small, most of the stocks closing at about the same level as a week ago. The Cobalt stocks were more active and there were heavy sales, especially of Cobalt Central and Kerr Lake. The Nevada gold stocks were more active than for some time past.

Subscriptions for the $30,000,000 Panama Canal bonds offered by the Treasury reached a total of over $102,000,000. The bids showed 102.4 average price.

Boston, Dec. 8—With a lessened volume of trading prices for mining shares have declined as a rule during the week, but no serious breaks are to be recorded. In a few instances prices are higher. Amalgamated sold off over $2 to $83.25, recovering but fractionally. No change is expected in the dividend to be declared this month. A sharp buying movement jumped the price of Lake Copper $3.50 to $24.50, the stock subsequently selling back close to $22. Osceola rose $8 to $134 on increased dividend expectations. Arcadian is off to $4 on a proposed plan to reorganize which will call for an assessment to provide for exploration. A short-lived selling movement put Adventure to $11, but the price is back to below $10.

It is noteworthy that a number of new mining flotations are coming out in the West, and are meeting with good success. Eventually they will find a market

in the East. Already one is quoted on the local curb, that of the Arizona-Michigan. It started at $2, but is now off to $1.50. Old Dominion touched $60.50 and Arizona Commercial $40, both reacting from these prices. Franklin is off $1 for the week to $18; Atlantic $1.37½ to $18.12½; Butte Coalition $1.25 to $27; Copper Range $1.25 to $81.25; North Butte $2.50 to $87.25. An item of interest is the fact that the three so-called Amster companies are loaning about $500,000 on the Street.

The Curb is now housed and has 125 members, its limited number, who have paid an initiation fee of $500 each. Several stocks traded in there will soon be taken over on to the Exchange, notably Batopilas, East Butte, Keweenaw Copper, North Lake and Superior & Boston. Ultimately Ahmeek, Chemung, Helvetia, Ojibway and others will graduate to the Exchange. Features on the Curb have been an advance of $1.87½ in East Butte to $9.25 and $3 in Superior & Boston to $18.50. Nipissing dropped $1.75 to $9, but it subsequently recovered most of the decline.

Denver, Colo, Dec. 5—A new stock exchange is spoken of for Denver. The intention is to devote attention chiefly to mining stocks. The latest accounts are that it is likely to be opened by Jan. 1, and it is stated that 50 seats have been signed for already. Mining, railroad and industrial securities will be traded in.

STOCK QUOTATIONS

NEW YORK	Dec. 8	BOSTON	Dec. 8
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	⅜	Adventure	9⅞
Amalgamated	83⅞	Allouez	39¼
Anaconda	49¾	Am. Zinc	‡26¾
Balaklala	‡2	Arcadian	4
British Col. Cop.	8	Arizona Com	39
Buffalo Mines	‡3⅝	Atlantic	18⅛
Butte Coalition	27¼	Bingham	‡.30
Colonial Silver	½	Boston Con	16¼
Cum. Ely Mining	8½	Calumet & Ariz*	119
Davis Daly	3½	Calumet & Hecla	680
Dominion Cop.	16	Centennial	‡34½
Douglas Copper	3⅞	Con. Mercur	.38
El Rayo	4	Copper Range*	81⅝
Florence	4⅛	Daly-West	11
Foster Cobalt	.35	Franklin	18
Furnace Creek	.13	Greene—Can	11¼
Giroux	6½	Isle Royal	24
Gold Hill	½	La Salle	15
Goldfield Con.	8½	Mass	7½
Granby	104	Michigan	‡14¾
Greene Gold	¼	Mohawk	70¼
Greene G. & S	7	Nevada	19⅞
Greenw'r & D.Val.	‡.75	North Butte*	85¼
Guanajuato	2	Old Colony	‡.65
Guggen. Exp.	‡186	Old Dominion	58
Hanapah	.15	Osceola	134
McKinley Dar.	1.05	Parrot	30
Micmac	2½	Quincy	96½
Mines Co. of Am.	1½	Rhode Island	‡6¼
Mitchell Mining	½	Santa Fe	12⅞
Mont. Sho. C.	1	Shannon	18⅛
Nev. Utah M. & S	3	Superior	‡33
Newhouse M. & S	6¼	Superior & Pitts.	18½
Nipissing Mines	10½	Tamarack	‡83
Old Hundred	3¾	Trinity	17
Silver Queen	1.02	United Cop., com.	14
Stewart	⅝	U. S. Oil	29¾
Tennessee Cop'r.	44	U. S. Smg. & Ref.	45
Tri-Bullion	1	U.S.Sm. & Re.,pd.	46½
Union Copper	⅞	Utah Con	46
Utah Apex	6⅛	Victoria	3¾
Utah Copper	48	Winona	6⅞
Yukon Gold	4¾	Wolverine	149
		Wyandotte	2¾

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	32¾
Am. Smelt. & Ref.	90¾
Am. Sm. & Ref. pf.	‡106
Colo. Fuel & Iron	40⅞
Federal M. & S., pf.	‡83
National Lead	82¾
National Lead, pf.	‡106
Pittsburg Coal	13
Republic I. & S.	26½
Republic I. & S., pf.	86¼
Sloss-Sheffield	78¾
Standard Oil	673
U. S. Steel	55⅞
U. S. Steel, pf	112⅝
Va. Car. Chem	43½

BOSTON CURB	
Ahmeek	120
Black Mt.	3⅛
Chemung	20
East Butte	9⅛
Globe Con	7⅛
Hancock	11¾
Helvetia	3¾
Keweenaw	5⅛
North Lake	8⅛
Ojibway	14
Superior & Bost.	17¾

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Nov. 28		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.05	.03
Center Cr'k	2.00	1.75
Cent. C. & C.	72.00	70.00
C.C. & C. pd.	78.00	76.00
Cent. Oil	110.00	100.00
Columbia	7.00	4.00
Con. Coal	22.00	20.00
Doe Run	130.00	115.00
Gra. Bimet.	.30	.25
St. Joe	15.00	12.50

LONDON Dec. 9	
Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'sInd.	0 2 6
Camp Bird	0 15 6
Esperanza	3 1 0
Tomboy	1 0 7½
El Oro	1 6 10½
Oroville	0 8 0

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Dec. 9.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.08
Belcher	.32	St. Ives	.20
Best & Belcher	.43	Triangle	.03
Caledonia	.17	BULLFROG STOCKS	
Challar	.07	Bullfrog Mining	‡.03
Comstock	.33	Bullfrog Nat. B	‡.04
Con. Cal. & Va	.77	Gibraltar	.03
Crown Point	.37	Gold Bar	‡.03
Exchequer	.35	Homestake King	.13
Gould & Curry	.10	Montgomery Mt.	‡.05
Hale & Norcross	.33	Mont. Shoshone C.	.93
Mexican	.82	Original Bullfrog	‡.01
Ophir	1.67	Tramp Cons	.10
Overman	.16	MISCELLANEOUS	
Potosi	.13	Bonnie Clare	.06
Savage	.22	Lee Gold Grotto	...
Sierra Nevada	.22	Nevada Hills	1.75
Union	.18	Nevada Smelting	1.00
Utah	.04	Nevada Wonder	.35
Yellow Jacket	.48	Nevada-Utah	2.93¾
TONOPAH STOCKS		Penn-Wyoming	.17
Belmont	.82	Pittsburgh S. Pk.	.80
Extension	.37	Rawhide Coal	1.40
Golden Anchor	.01	Round Mt. Sphinx	.15
Jim Butler	.16		
MacNamara	.33		
Midway	.18		
Montana	.83		
North Star	.04		
Tono'h Mine of N.	5.50		
West End Con	.33		
GOLDFI'D STOCKS			
Adams	.03		
Atlanta	.16½		
Booth	.20		
Columbia Mt	.17		
Comb. Frac	1.39		
Con. Red Top	.16½		
Cracker Jack	.04		
Dia'dfield B. B. C.	.11½		
Goldfield Belmont	.05		
Goldfield Daisy	.73		
Great Bend	.24		
Jumbo Extension	.18		
Kendall	.09		
Lone Star	.05		
May Queen	.04		
N. Y. C. O. D.	‡.10		
Oro	.12		
Red Hill	.18		
Roanoke	...		
Sandstorm	.20		

COLO. SPRINGS Nov. 28	
Name of Comp.	Clg.
Acacia	7¾
Black Bell	....
C. C. Con	4
Dante	6
Doctor Jack Pot	8½
Elkton	68¾
El Paso	49¾
Findlay	‡17
Gold Dollar	9⅛
Gold Sovereign	3¼
Isabella	26⅝
Index	....
Jennie Sample	7
Jerry Johnson	‡3⅞
Mary McKinney	32½
Pharmacist	4
Portland	1.04
Un. Gold Mines	3⅞
Vindicator	80
Work	7½

Assessments

Company.	Delinq.	Sale.	Amt.
Blackjack Con., Utah	Dec. 15	Jan. 6	$0.01
Challenge, Nev	Dec. 11	Jan. 5	0.05
Con. Cal. & Va., Nev	Nov. 24	Dec. 15	0.20
Confidence, Nev	Dec. 9	Dec. 30	0.20
Ely Con., Nev	Nov. 28	Jan. 11	0.02
Exchequer, Nev	Dec. 30	Jan. 20	0.05
Julia Con., Nev	Dec. 21	Jan. 15	0.03
Little Chief, Utah	Dec. 15	Jan. 5	0.01
Lower Mammoth, Utah	Dec. 18	Jan. 8	0.05
Lucky Dutchman, Nev	Nov. 21	Dec. 12	0.01
Mountain Dell	Dec. 24	Jan. 12	0.02
New York Con., Nev	Dec. 18	Jan. 8	0.03
Oro Cobre, Cal	Dec. 31	Jan. 16	0.02
Overman, Nev	Dec. 2	Dec. 23	0.05
Prudential, Cal	Dec. 3	Dec. 21	0.05
Roosevelt Oil, Cal	Nov. 30	Dec. 19	0.03
Union Con., Nev	Dec. 23	Jan. 14	0.10
Wabash, Utah	Nov. 10	Dec. 3	0.08
Washakie-Nev., Utah	Nov. 27	Dec. 18	0.10
Yellow Jacket, Nev	Dec. 28	Feb. 3	0.15
Zelbright, Cal	Dec. 1	Dec. 17	0.05

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25.738
February	68.835	56.000	31.852	25.856
March	67.519	55.365	31.325	25.570
April	65.462	54.505	30.253	25.133
May	65.971	52.795	30.471	24.377
June	67.090	53.663	30.893	24.760
July	68.144	53.115	31.366	24.514
August	68.745	51.683	31.637	23.858
September	67.792	51.720	31.313	23.877
October	62.435	51.431	28.863	23.725
November	58.677	49.647	27.154	22.933
December	54.565	.....	25.362	.....
Year	65.327	.....	30.188	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24.404	13.726	24.825	13.901	106.739	62.386
February	24.869	12.905	25.236	13.098	107.356	58.786
March	25.065	12.704	25.560	12.875	106.594	58.761
April	24.224	12.743	25.260	12.928	98.625	58.331
May	24.048	12.598	25.072	12.788	102.375	57.387
June	21.665	12.675	24.140	12.877	97.272	57.842
July	22.130	12.702	21.923	12.933	95.016	57.989
August	18.356	13.462	19.255	13.639	79.679	60.500
September	15.565	13.388	16.047	13.600	68.375	60.338
October	13.169	13.354	13.551	13.646	60.717	60.139
November	13.391	14.130	13.870	14.386	61.226	63.417
December	13.163	.....	13.393	.....	60.113	.....
Year	20.004	.....	20.661	.....	87.007	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	29.207
February	42.102	28.978	August	37.667	29.942
March	41.313	30.577	September	36.689	28.815
April	40.938	31.702	October	32.620	29.444
May	42.149	30.015	November	30.833	30.348
June	42.120	28.024	December	27.925	.....
			Av. year.	38.160	.....

Prices are in cents per pound.

LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	3.725	19.531	14.250
March	6.000	3.838	19.703	13.975
April	6.000	3.993	19.975	13.469
May	6.000	4.253	19.688	12.938
June	5.760	4.466	20.188	12.600
July	5.288	4.447	20.350	13.000
August	5.250	4.580	19.063	13.375
September	4.813	4.515	19.775	13.125
October	4.750	4.351	18.531	13.375
November	4.376	4.330	17.281	13.538
December	3.658	.....	14.500	.....
Year	5.325	.....	19.034	.....

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.513	6.582	4.363	27.125	20.563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6.837	4.665	6.687	4.527	26 094	21.075
April	6.685	4.645	6.535	4.495	25.900	21.344
May	6.441	4.608	6.291	4.458	25.563	19.906
June	6.419	4.543	6.269	4.393	25.469	19.000
July	6.072	4.485	5.922	4.338	23.850	19.031
August	5.701	4.702	5.551	4.556	21.969	19.350
September	5.236	4.769	5.086	4.619	21.050	19.563
October	5.430	4.801	5.280	4.651	21.781	19.750
November	4.925	5.059	4.775	4.909	21.438	20.875
December	4.254	.....	4.104	.....	20.075	.....
Year	5.962	.....	5.812	.....	23.771	

New York and St. Louis, cents per pound. London in pounds sterling per long ton.